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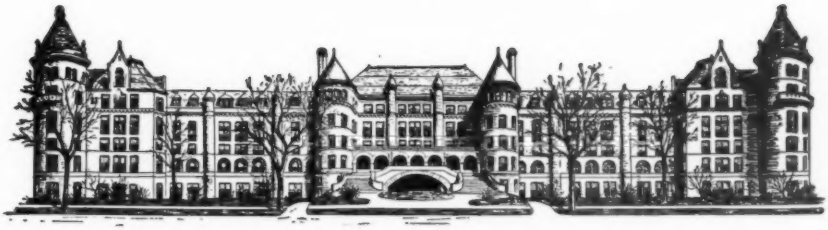

THE AMERICAN MUSEUM JOURNAL

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MARY CYNTHIA DICKERSON, *Editor*

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KOREAN ARTISTS WERE UNRIVALED DESIGNERS

Japanese, and even much of Chinese art, owes its inspiration to Korea, the work of whose artists combines beauty of design, richness of coloring and skillful technique to a degree which makes it well worth study by artists of today. This back of a kimono is an unusually fine specimen of ancient Korean art, authentic examples of which are rare. The central figure represents a cock changed into the form of the sun, of which it is the symbol in Celestial art. Below are wave motives, and clouds appear above

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Design and Color in Ancient Fabrics

ACTIVITY OF COMMERCIAL CONCERNS OF TODAY IN MAKING USE OF ANTIQUE PATTERNS FOUND IN THE TEMPLES AND TOMBS OF THE PREHISTORIC NEW WORLD AND NOW ON EXHIBITION IN THE AMERICAN MUSEUM OF NATURAL HISTORY

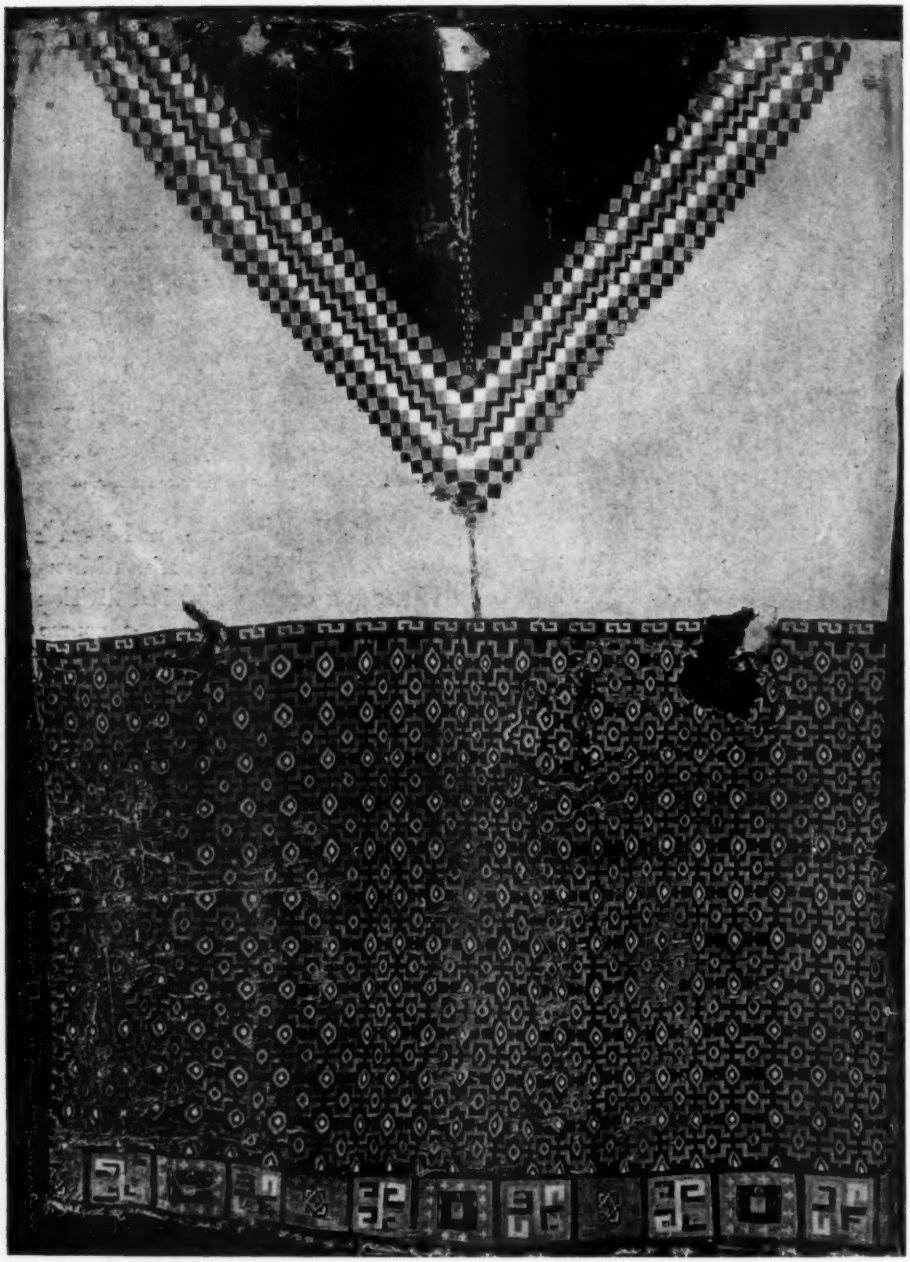
By M. D. C. CRAWFORD

With photographs of specimens of ancient weaving and embroidery in the American Museum

IT is easy to speak of future plans in glowing terms; it is comparatively simple to analyze an accomplished work; but it is perplexing to speak of a movement in its initial stages. Thus I find it rather difficult to describe how museum collections are being used by the textile industries to assist in the creation of designs. There are so many personalities connected with an active campaign of this kind that the task is extremely delicate, but in order that the general public and the members of the American Museum may fully realize the seriousness of the undertaking, what measure of success has already been accomplished, and what hopes there are for the future, some brief account of the details is necessary.

The idea that the great textile industries should make use of museum collections came from Dr. Clark Wissler. In conversation with me he remarked on the fact that American designers should be interested in the great art of the New World and more generally in the collections that were under his charge. He felt that here was fresh artistic inspiration of great value. It was agreed that the only thing necessary was that these people should be brought into close contact with the collections and learn how to make use of the American Museum. We agreed upon a practical division of labor: he was to arrange a course of lectures especially for textile people; and through my acquaintance in the textile industry I was to furnish an audience capable of appreciating such a course and able to give expression to such ideas as they might obtain from it.

In my part of the program, great assistance was given the movement by the editors and owner of *Women's Wear*, a daily devoted to the textile and allied interests. Through the courtesy of Mr. E. W. Fairchild, practically unlimited space was given for publicity, even to the extent of publishing primitive designs, in order to excite the interest of American designers. Nor did Mr. Fairchild's enthusiasm stop there. He has given encouragement to American artists by offering prizes for the best textile designs suggested by the Museum collections, in this way serving the triple purpose of introducing designers and mills to museum collections, of encouraging designers, and of bringing mills and designers into closer relation. The contest is to close December 15, and if space permits, there may be an



THE MOST WONDERFUL TEXTILES OF THE WORLD COME FROM PERU

This poncho from Tiahuanaco, Bolivia, is typical of the best work of pre-Incan Peru. It is a tapestry weave, the class of fabric in which the Peruvians reached their highest textile development, and the vicuña yarns are so soft and fine as to give almost the feeling of silk. These fabrics antedate the Spanish conquest by two thousand years and are even more priceless as an art expression than as an exhibit of mechanical skill, uniting exquisite color combinations with a fine sense of proportion. The balance of the design is perfect. The solid color around the neck is a beautiful deep red and the checkered portion is black and gold with occasional red dots

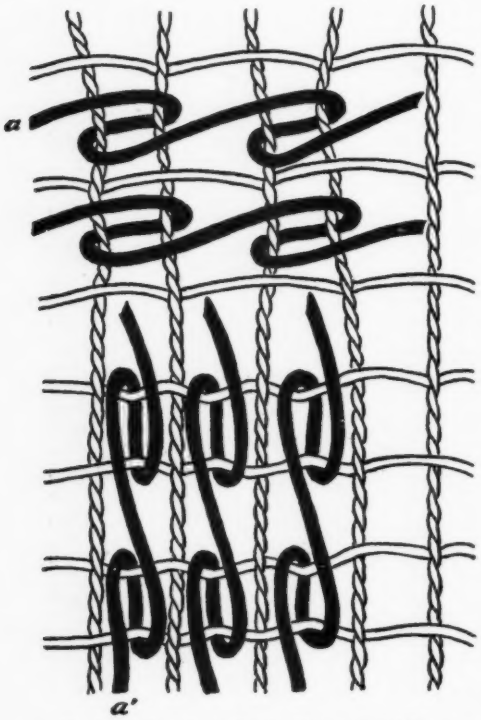
exhibit of the successful designs. Perhaps, at a later date, an exhibition may be arranged of hand-decorated textiles, and later still a large exhibition of the products of our great mills, the inspiration for which has been suggested by the art objects in the American Museum of Natural History.

During the summer, representatives from many silk concerns and one or two cotton houses making fine novelty goods, visited the Museum and made at least a beginning of a careful research into the elements of primitive design. A very enterprising concern of silk printers was especially active, and there is in course of manufacture at this time a large number of patterns which were created from the specimens on exhibition. A well-known retailer came several times and is now using on ladies' wearing apparel the designs which he took from the same source. This aid to American designers came at a most opportune time, for the condition abroad made it impossible for our great industry to get decorative suggestions from the usual sources. It was therefore judged that this was the psychological moment to exert effort toward the development of a typically American school of design. It can be said that the practical progress being made is already astonishing.

The actual woven fabric is by no means the only class of objects which can suggest textile design. Basketry, pottery, carved wood, and many other objects, display designs which require only a little adaptation to become applicable to modern fabrics; but it would be impossible even to suggest the extent of these resources at this time and I must confine myself exclusively to fabrics. In these, Peru is easily the most valuable source — in point of beauty, technical interest, and number of specimens. About three years ago I undertook the textile analysis of the wonderful Peruvian collection of the American Museum, and while I am now more familiar than I then was with the other collections in the

Fragment of the border of an Ica shawl, in which a basic fabric is completely covered with embroidery. The design represents the puma god destroying a man. The large shawl-like garments from Ica, Peru, in the Juilliard collection of the American Museum, present grotesque animalistic designs, in which however the color combinations are incomparably beautiful

Museum, and have come to a more definite condition of mind as to the art value of all the great anthropological collections, yet my first enthusiasm for the beautiful textiles of the Lost Empire is in no sense abated. In fact, each visit, I make to the Peruvian hall increases my admiration for the wonderful color effects and knowledge of design which these old masters possessed.



To obtain the effect of embroidery completely covering the basic fabric the decorative yarn is laced a full turn over pairs of threads, either of warp or weft according to the requirements of the design. A very loose basic web is necessary to permit of this change in direction of the embroidery thread

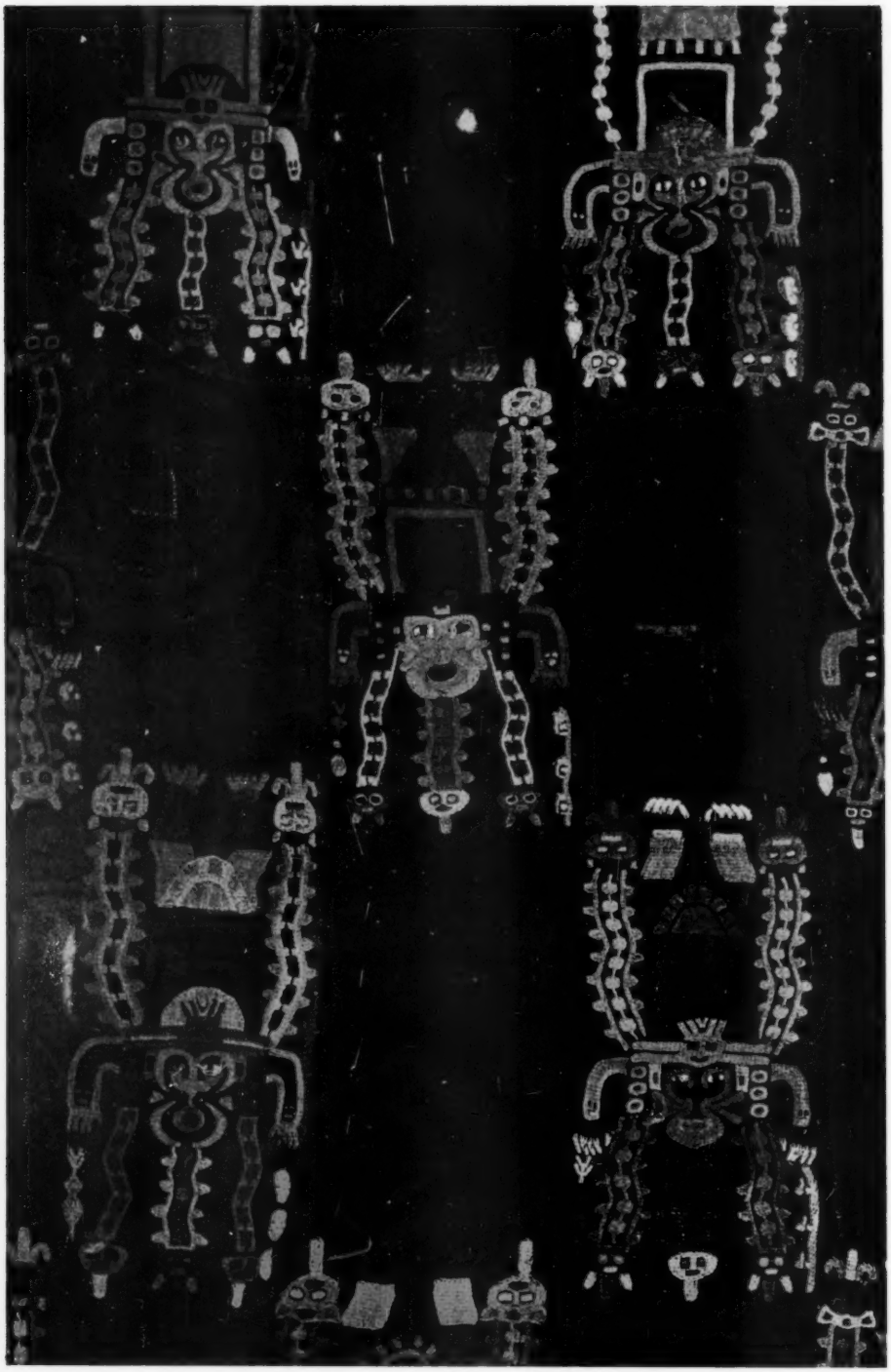
Next in importance come the collections of garments and fabrics from the Amur River tribes and those belonging to China proper. The embroidered garments of the Koryak tribe of Siberia have also attracted a great deal of attention, and the Mexican and Southwest halls have been visited by artists capable of adapting material from many different objects. One designer in particular is doing some very original work under the direction of Dr. Herbert J. Spinden, showing the way toward the development of interest in a great art which until this time has received too little attention from the textile world.

The fabrics of Peru are beyond all question the most interesting technical and artistic record of textile history. Compared with them, the Coptic fabrics represent a very limited development, and even the interesting cloths recently excavated in Turkestan by Sir Aurel Stein are but a fragmentary record of the art they represent. In Peru every process of decoration of which we know is found — every trick of the weaver's art, every skillful blending of colors. Indeed in some of their techniques and color combinations they far surpass modern work. Nor is this a record of scattered fragments. Even the rarer techniques are well represented, and there is enough material (as one prominent silk man remarked) to furnish inspiration for a century of design. Of course, practical textile people do not come to the Museum to get technical information. The value of the collections to them is almost entirely of an æsthetic nature. Still, I have always felt that careful research, accompanied by experiments, might result in the working out of even new technical methods. Color and form are however, the principal things, and in these the collections are wonderfully rich.

The recent gifts to the Museum by Mr. A. D. Juilliard, of textiles from Nazca and Ica, contain some of the most wonderful and beautiful color combinations of any fabrics, be their origin what it may. The shawl-like garments from Ica are especially rich in this particular. They are embroidery designs, the basis

DESIGN SUBSERVES COLOR IN THESE ICA SHAWLS

The embroidered design decorating this fabric is a representation of the puma god repeatedly reproduced in varying color combinations, and the units of design, in this and the other shawl-like garments from Ica in the Juilliard collection, are employed as convenient forms for the massing of colors rather than to exhibit beauty of line. The color combinations achieved in these fabrics are exquisite beyond description, implying a knowledge of color values as fine as the world has ever seen. The figures are in blues, greens, reds, browns, and yellows, on a black ground, while in the border the groundwork is red, and black is used in the figures. All the decorative arts of today requiring the use of strong color could profit inestimably by a study of these perfect specimens

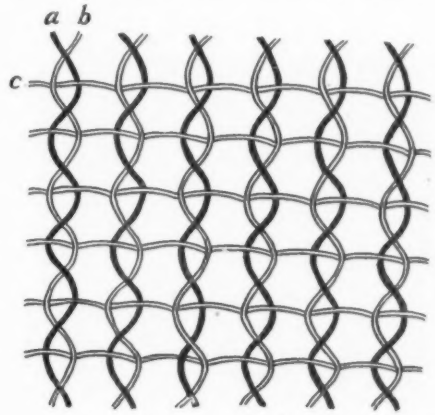


PERUVIAN EMBROIDERY EXCELS IN TECHNIQUE

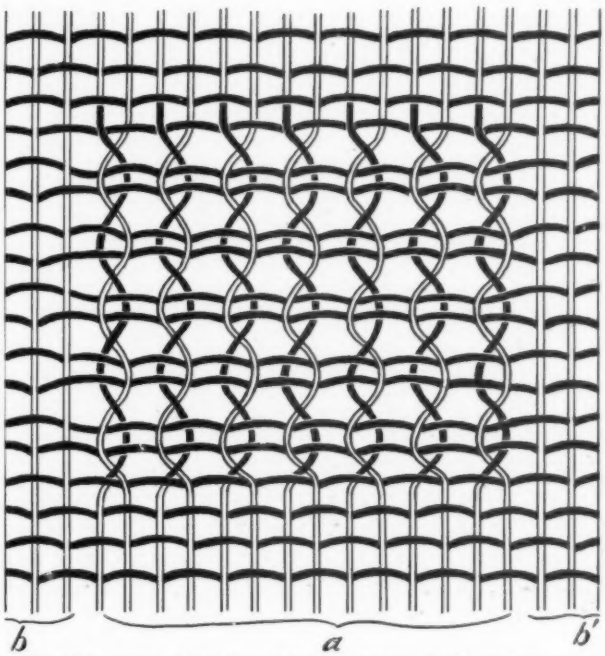
In this example of embroidery from the Juilliard collection, in which again the puma god supplies the motive, an especial refinement of technique is used, in which the fabric under the embroidery changes from a plain web to a gauze, the latter permitting the application of the decorative stitches more easily and evenly. Embroidery on gauze is a very ancient art and as still practised by Italian peasants is known as *buratto*, but the introduction of gauze areas into a hand loom web in this way involves a degree of skill and a refinement of workmanship which is eloquent of the craft pride of the ancient Peruvian weavers. The color scheme of this fabric uses various shades of blues, yellows, reds, browns for the figures, on a black ground

of which is a gauze or a leno. Strangely enough, this same technique is used in Italy today and is known as *buratto.* The designs are made up of the repetition of a single figure in varying color combinations. No two figures are exactly alike in color arrangement, yet each figure is a perfect color combination in itself and the whole fabric is beautifully harmonious. An artist said to me the other day that if any one could analyze the rules which governed the combination of colors in a single unit, he would know more about colors and their values than does any living man. Nine of these beautiful fabrics were presented by Mr. Juilliard with other only less interesting material, and no finer artistic inspiration can be found than in a careful study of them. The modern theory, recently advanced, that colors and music have some relation, might be applied to these perfect specimens and tested for accuracy by their harmonies.

A more technical discussion of the method of decorating these shawls may not be out of place. This technique is an interesting species of embroidery, and fragmentary specimens have occurred in the region around modern Lima. But in Ica we find the technique intensified, and it becomes the dominant method of textile expression in this part of the world. The object evidently has been to obtain a method of expression which would permit a repetition of the same figure in varying color combinations, and while the units of design are of a more or less terrifying nature, yet the way in which they have been arranged and the details



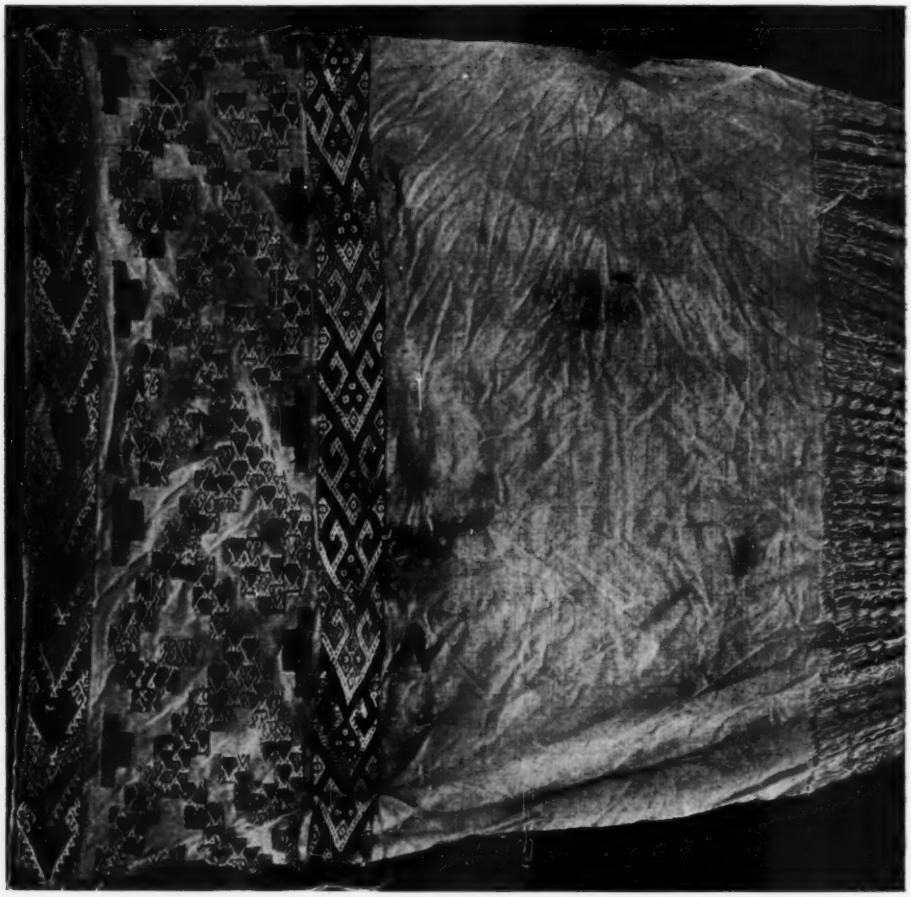
The even open squares produced by a gauze weave are well adapted for the application of embroidery. The principle of gauze weaving is that adjoining warps or groups of warps are twisted one-half turn about each other and the crosses made secure by insertion of weft



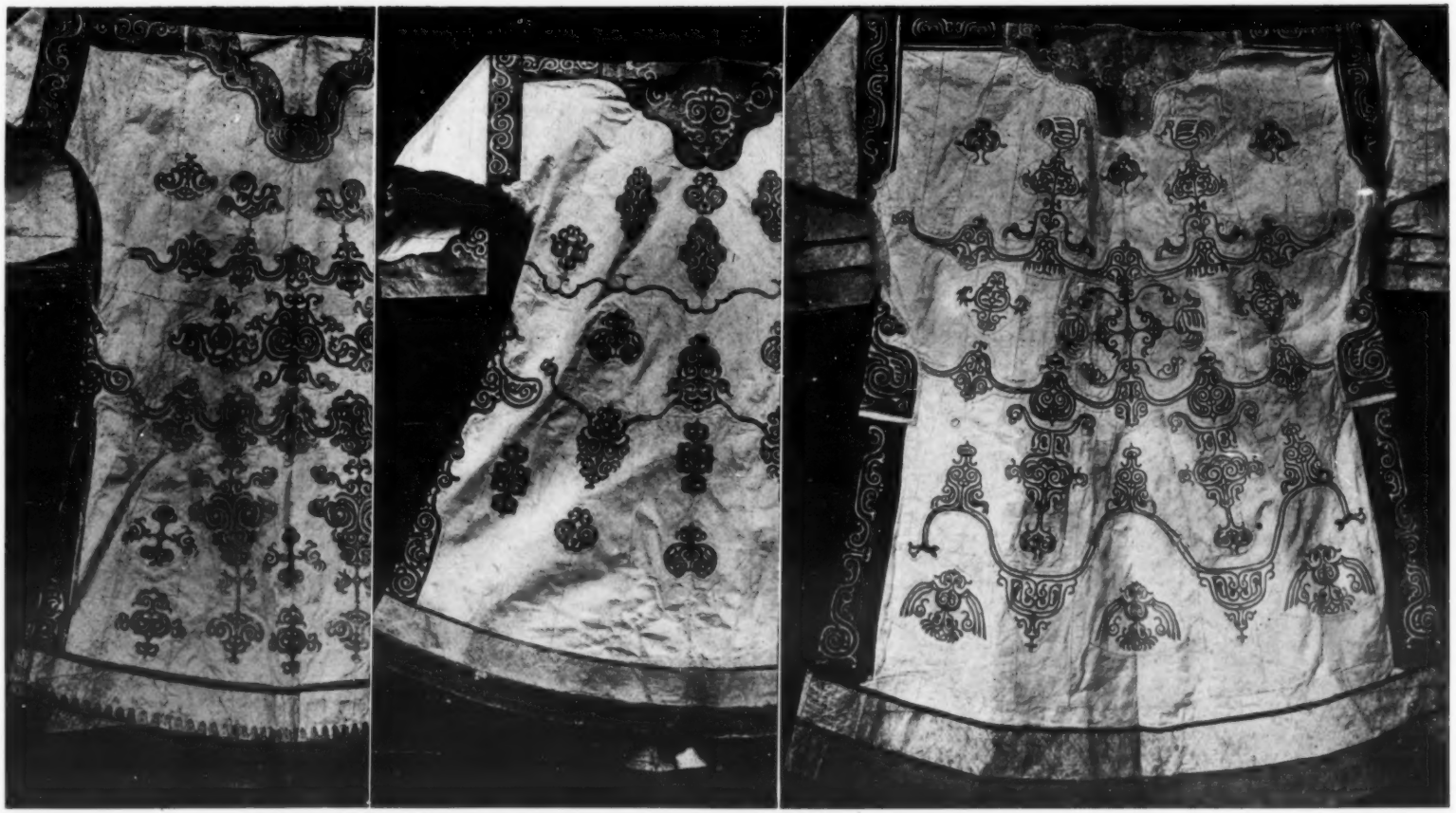
The plain weave of the basic fabric in the Ica shawls changes into a gauze weave in the areas to be covered by the embroidery. This technique explains the extreme evenness of the embroidery stitches regardless of the angle at which the needle worked. *a*, area in which the plain weave changes to gauze; *b*, *b'*, plain weave of fabric outside of embroidered area

distorted, indicates that they owe their latest form to the desire on the artist's part to produce a unit of design adapted to artistic grouping of colors. It has been the object to show color harmonies rather than beauty of line.

We are in the habit of seeing embroidery stitches more or less uneven and not following exact rules such as woven designs create. Here however, each stitch is the exact counterpart of every other and the embroidery has been applied in such a way as to cover completely the basic fabric. Embroidery in its freedom from convention more nearly corresponds to hand painting than does the woven web, and this freedom has been taken advantage of in these cloths. The basic fabric under the embroidery in some webs changes from a plain weave, which is the background of the cloth, to a gauze. The warps have been partially twisted around one another and the turns made constant by the insertion of



To the custom of burying with the dead all unfinished work we are indebted for this example of weaving from Ica, Peru, shown just as it was taken from the loom many centuries ago. The skill of the Peruvian workers enabled them to make embroidery (in which the decorative thread is applied to the finished fabric) which closely resembled brocade (in which the decorative thread enters the design during the weaving), and this particular web cleared up a difficult question as to whether certain fabrics were embroidered or brocaded. The fact that the decorative thread is contained in the unfinished web proves this specimen to be brocade, and a comparison of this with other fabrics has made details of differentiation fairly certain



DESIGNS FROM THE AMUR RIVER TRIBES OF EASTERN SIBERIA

These particular garments have proved very interesting to textile designers of New York City. They are made of fish skin, the design being cut out of pieces of fish skin, usually dyed blue, and sewed on with fish-skin thread. Although the basis of the art of the Amur River tribes rests undeniably in China, the designs have been developed along lines which give them a distinctly native character. The animal figures, notably the cock, fish, and dragon, are however those which figure in Chinese art and mythology

This beautiful kimono from Korea is a very fine example of brocade, the decoration being woven into the fabric while on the loom. The bold and spirited dragon design, with water and cloud motives, is characteristic. Old gold, greens, blues, and a beautiful shade of red, form the coloring on a dark blue field. This is a marvelous example of skillful weaving, and is besides in the best spirit of Korean art

weft. The embroidery stitch here passes completely around the threads making the sides of these minute squares, and would therefore be practically even. When the embroidery threads are taken out, they have a resemblance to corkscrews.

The pottery, as well as the woven fabrics from Nazca and Ica, shows a remarkable love of color and indicates knowledge of chromatic harmony. Perhaps the art of these people was too greatly influenced by their superstition, for they have a greater leaning toward animalistic forms than is found in the Tiahuanaco area, where the culture was more highly developed; but in colors they were supreme and these shawl-like garments are the finest examples of their art.

Some time ago, a distinguished expert on Oriental rugs, Mr. John Kimberly Mumford, was looking at this American Museum collection. He had brought me some small fragments of wonderful Oriental rugs, that I might analyze them for their construction. These fragments had come from some of the finest carpets in America, and represented perhaps the highest type of coloring in textiles from Asia. The beauty of this art has been described so often and is so much a matter of popular knowledge that to question the supremacy of the rugs of Herat or Ispahan may sound like artistic heresy. Certainly that would have been my judgment until the comparison was made; but it was made by Mr. Mumford himself, who placed the fragments on one of the shawls which we had unrolled for his inspection. He frankly admitted that the work of the Peruvian artists was superior.

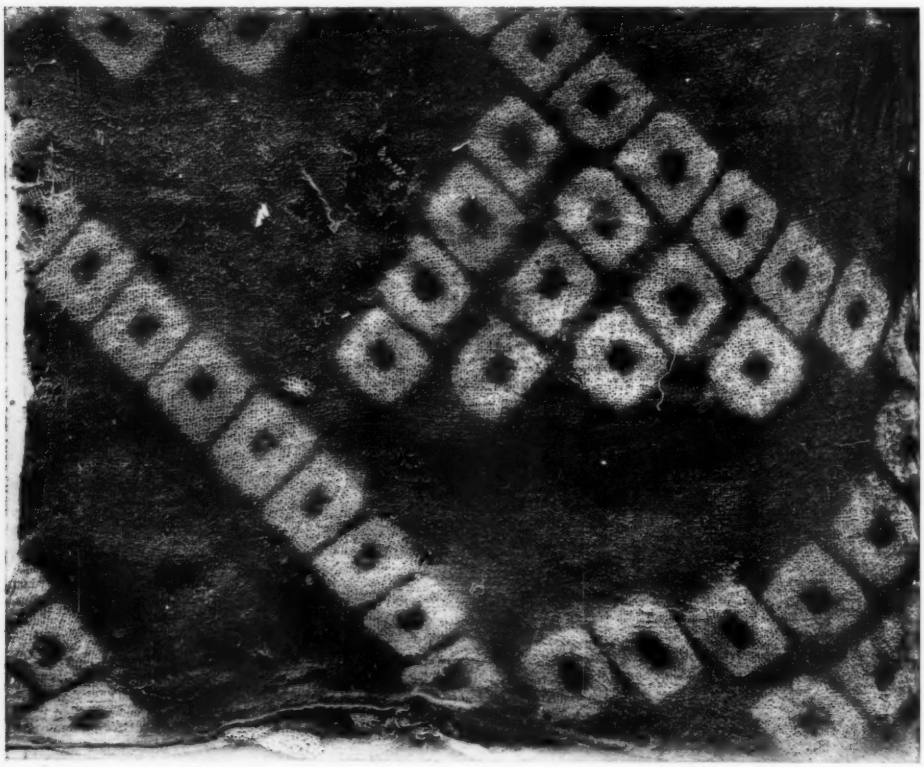
There can be no doubt that these shawls represent the highest development in color as applied to textiles. They are unsurpassed masterpieces and their addition to the Museum's collec-

KORYAK FUR COATS HAVE RICHLY EMBROIDERED BORDERS

The Koryak tribe of Siberian natives had come in contact with Russian influence a century or more before these coats were made, and had undoubtedly absorbed much from Russian art. The band on the central coat is a purely Russian floral convention, and very similar forms may be found in Russian enamel and weaving; the geometric designs are probably the remains of the primitive art of this people. The whole treatment is extremely spirited and has been highly commented upon by competent designers; indeed the collection of Koryak fur coats in the American Museum has had a pronounced influence on textile art for the winter season of 1916–17 in the United States

tion is of incalculable value. They should serve for generations as an artistic inspiration to designers and artists, and if properly studied and applied, they must have untold influence on the æsthetic development of America.

The Amur River tribes have left us a record of primitive Chinese motives which, in their simplicity and strength, should be a help to modern designers. In the collection of bronzes of ancient China, there is literally a mine of æsthetic suggestions. The great collection of modern Chinese embroideries is not illustrated for lack of space, and because most readers are familiar with this class of art; although it may be said that this collection is very much worth while to textile designers. But Korea is another question, for authentic examples of that wonderful people's art are very scarce. The Museum collection of art from this part of the world is not as extensive as could be wished, and the same might be said of the wonderful fabrics from Sumatra and Java. Where these collections fail, however, the library comes to our aid with much valuable material for designers, especially with a certain book of three volumes, *De Inlandsche Kunstnijverheid*



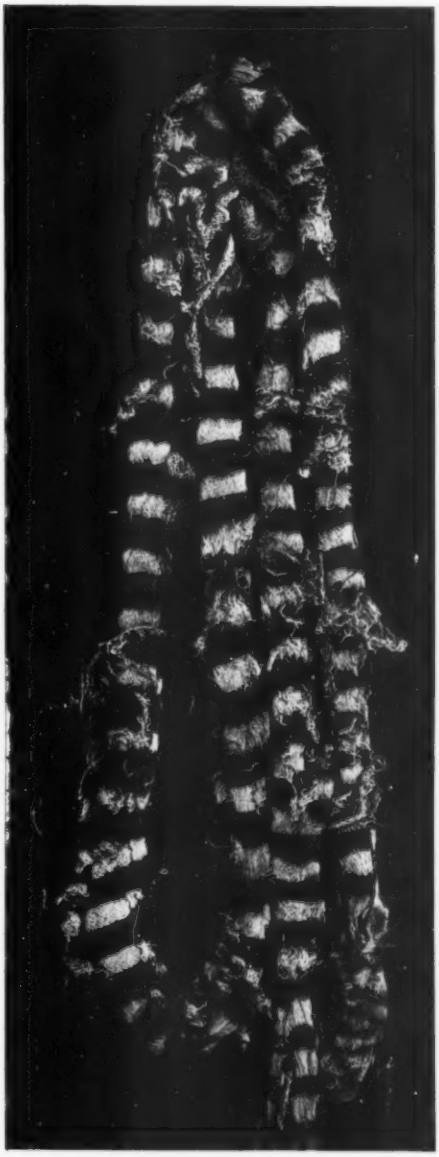
Tie or resist dyeing is a very ancient art and consists in so treating the fabric that when put in the dye pot only certain portions of it absorb the colors. This is achieved by tying little bunches of the cloth with a cord which resists the dye, producing a pattern when the cord is removed. The art was well known in India, and Moslem conquests spread the method in the Philippines, where the Bagobo tribes are especially skillful, using it for their "bandanna" headdresses. Also the Moors carried the craft into Spain whence it spread to Mexico. Except in Peru, where it only exists in the simplest form, the origin of this decorative method can be clearly traced to Asia. The fabric shown above is from Peru

in Nederlandsch Indië, by J. E. Jasper en Mas Pirngadie, published in 1916.

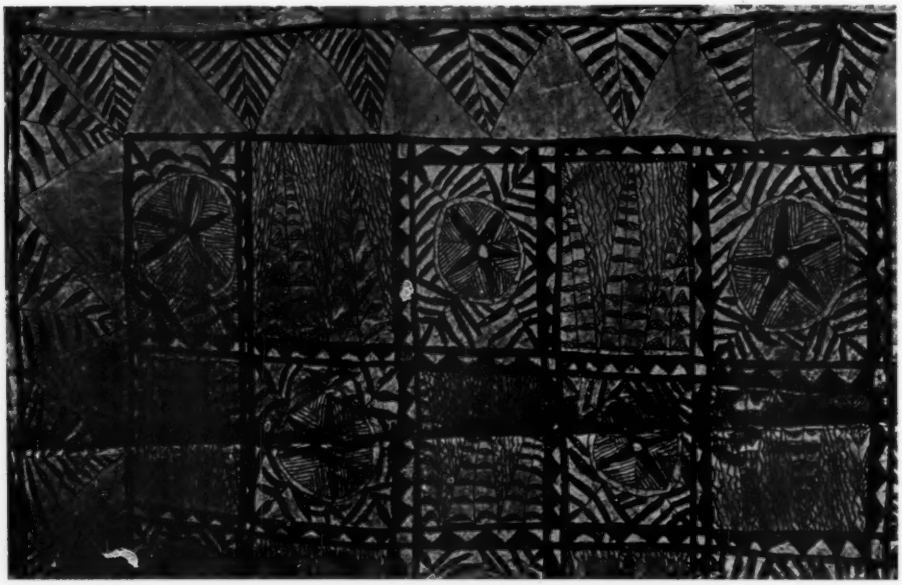
The collection of Koryak and Yakut fur coats and leggings gives us some strong Russian ideas, mixed with the more primitive art of these tribes. It will be rather interesting this year for people who are familiar with the American Museum collections to observe how modern artists have adapted these motives to their different techniques.

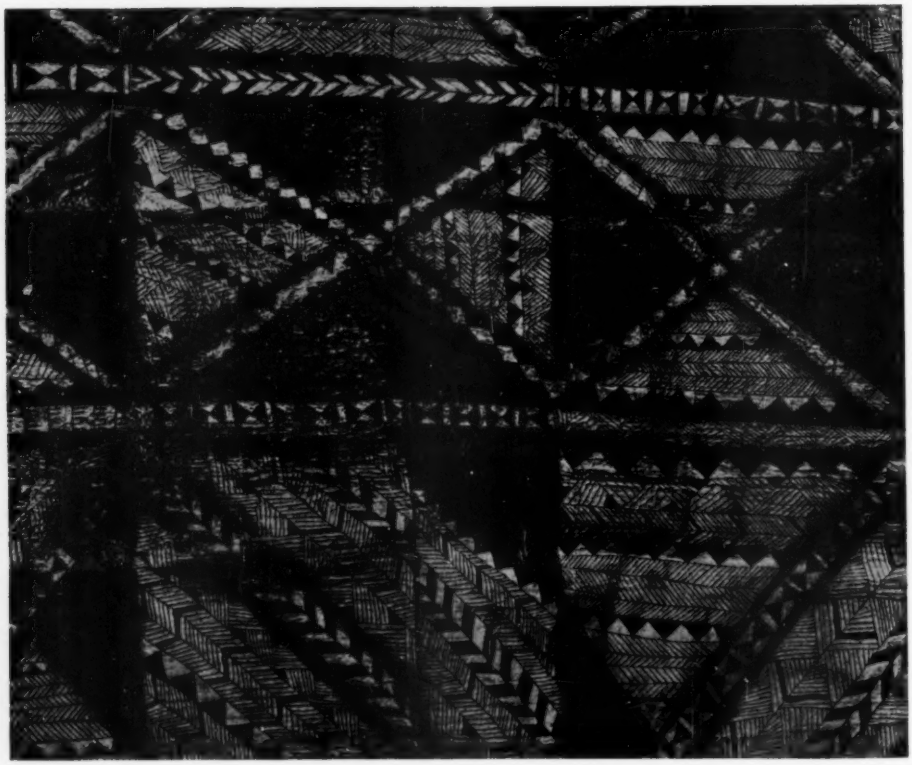
The collection from the Philippine Islands shows some very remarkable methods of fabric decoration, the tie-dyed or "bandanna" headdresses of the Bagobo tribes, and the hemp cloths. In these the warps have been tied and then dyed. The design is thus produced by those portions of the warp which were covered by the thread which tied them when they were dipped into the dye pot. Curiously enough, both these methods have come down to us in modern mechanical processes. The first, "bandanna," or simple tying and dyeing, corresponds to modern mastic printing, in which the fabric has the design printed on it in hot beeswax, and is then immersed in a bath of cold dye. The second corresponds to the modern method of printing on warps (that is, on the threads that run the length of the piece) and then weaving with a plain web.

The attitude of the American Museum toward artists — in fact, toward any class of people seeking information — has always been most gracious and generous. Those who have come to use the collections have always found that they have been met more than halfway by the staff. Almost every week some one comes to me outside of the Museum and pays glowing tribute to some individual or some collection, and these of course I cannot write of, except to say that one gentleman, Mr. C. W. Mead, in charge of South American antiquities, has recently become acquainted with many textile designers. It seems reasonable to hope, from the results already accom-



An interesting method of making stripes by a dye process consists in rolling the cloth diagonally into a sausage-like form, and tying with some thread which resists the dye. After dyeing, diagonal stripes appear when the fabric is unrolled. The cloth illustrated is a coarse Peruvian cotton of about the same mesh as modern mosquito netting





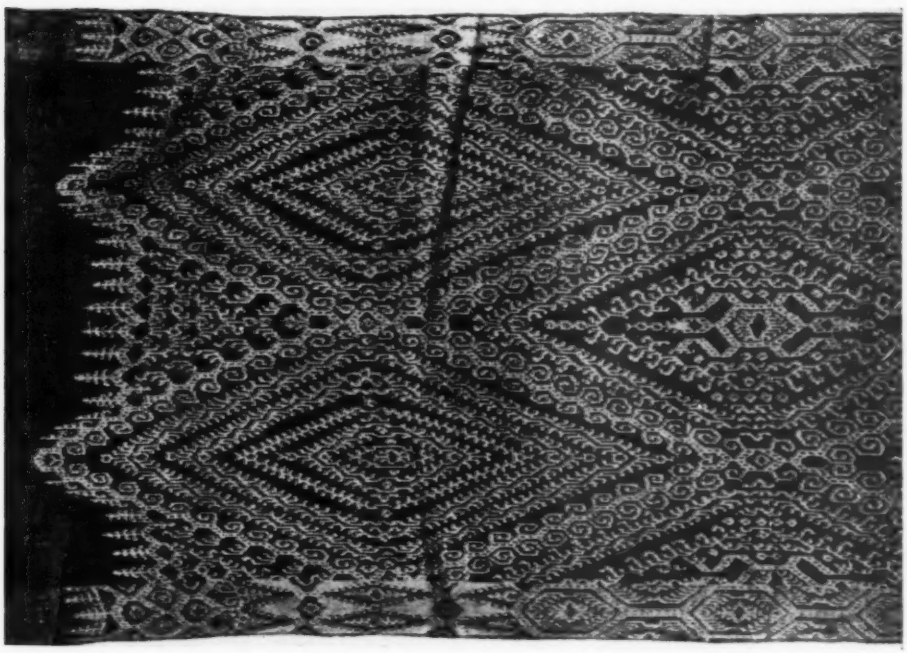
Tapa cloth, made from the inner bark of the paper mulberry tree beaten out thin, is used in many parts of the tropical world. The upper specimen, from Hawaii, is probably painted by hand; the lower, from Fiji, probably printed by a rude plate-printing method, in which strings were fastened on bark to form a design and dye was applied, after which the pattern was transferred to the material by pressure. The coloring is black and white, or black, red, and white

plished, that American designs taken from the Museum will be extensively used this season, and it may also be said that the tendency among designers to create fabrics from the art of the New World and to give the public a thorough knowledge of the æsthetic value of this art, may not be far distant.

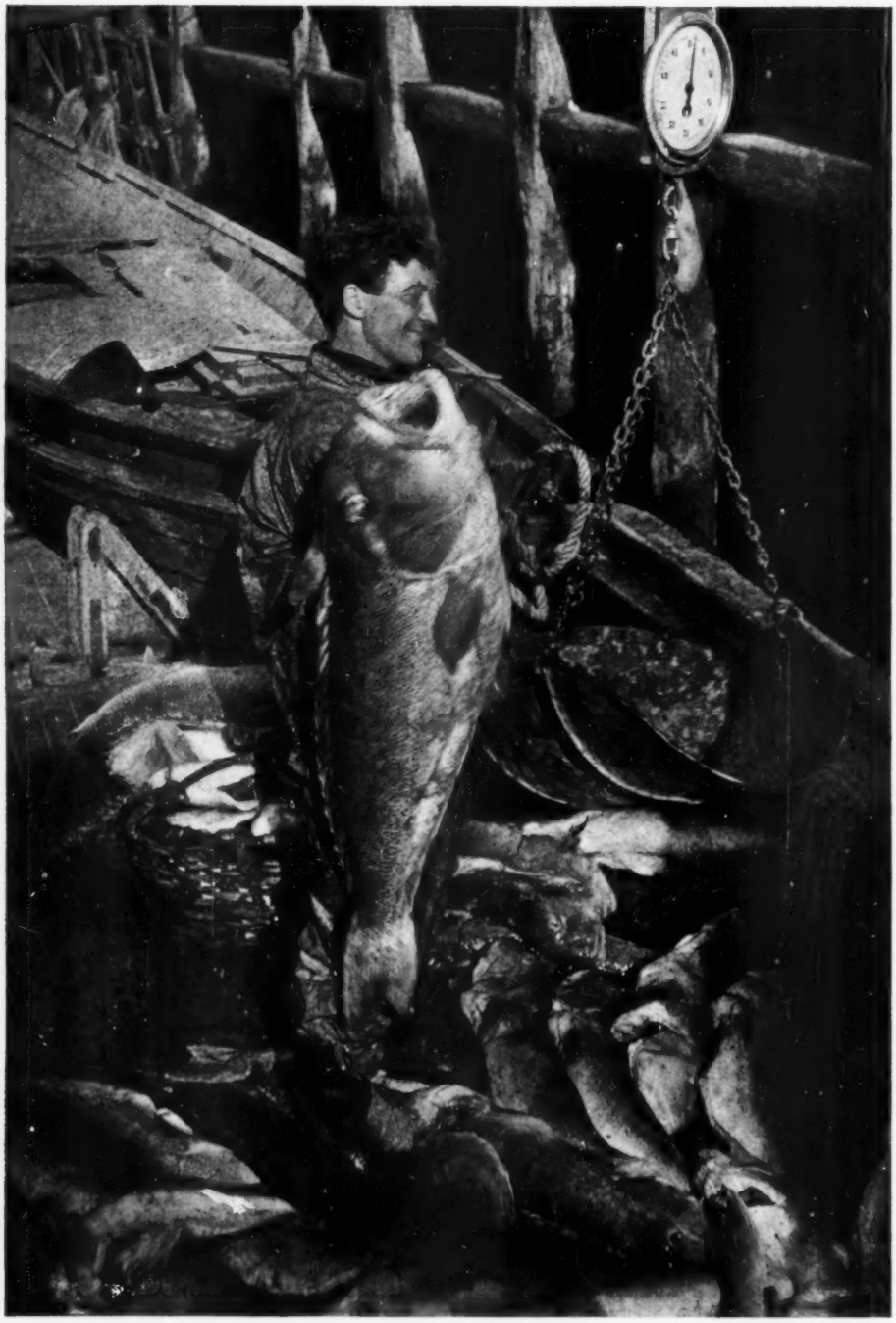
Our designers have formerly relied almost exclusively upon suggestions from foreign sources. They had not learned the value of museum research, nor had they formed the least idea of how extensive the local collections are. Of course, the lack of this interest has prevented our collections from being developed with commercial problems in view. The material here has been gathered with a general view to art and science, and has not been arranged for any specific class of artists. Perhaps when the great mills for wearing apparel have successfully created fabrics from these things, the next move will be to reach the makers of upholstery and draperies—and, in short, the workers in the entire field of decorative art, that their energies also may be directed to the material contained in the American Museum of Natural History.

NOTE BY THE EDITOR.— For those readers of the JOURNAL who have access to the back files and are particularly interested in possible ancient sources of modern design, attention is called to the following articles and their illustrations:

Navajo Blankets, pp. 201–211, November, 1910; *The Fish Design on Peruvian Mummy Cloths*, pp. 251–254, December, 1910; *Ancient Chinese Bronzes*, pp. 59–65, February, 1911; *Bagobo Fine Art Collection*, pp. 164–171, May, 1911; *The Making of Pottery at San Ildefonso*, pp. 192–196, October, 1911; *Saltillo and Chimayo Blankets*, pp. 32–34, January, 1912; *Ancient Pottery from Nazca, Peru*, pp. 207–208, May, 1914; and in issues of the given year, *Decorative Value of American Indian Art*, pp. 301–307, May, 1916; *The Loom in the New World*, and *Ancient Peruvian Cloths*, pp. 381–393, October, 1916.



A choice Philippine woven fabric (Bagobo), in which the design is the result of tying the hemp fiber before it is dyed



Courtesy of Paramount Pictures Corporation

A FINE SPECIMEN

Tilefish, rediscovered in quantity about 1898, was practically unknown on the market until the latter end of 1915, when the United States Bureau of Fisheries induced Captain Carl C. Young, of Gloucester, to fit out a schooner. Captain Young made four trips. He had difficulty in disposing of his first haul, but the Bureau undertook to make the fish known, and before the fourth trip was over, tilefish was selling well and other men were enthusiastically engaging in the fishery

The United States Fish Commission schooner, "Grampus," 1899, setting out from Woods Hole to investigate the distribution of the tilefish grounds

Tilefishing in Fifty Fathoms

By GEORGE H. SHERWOOD

"NOW I want you to drop everything, pack your duds and report on the 'Grampus' at once. She will sail in half an hour." There was no appeal from this command of the director and within the allotted time I was on board the United States Fish Commission schooner "Grampus," and my first experience on deep water had begun.

It was in the latter part of August, 1899, and the "Grampus," in command of Captain Hahn, was about to leave the government station at Woods Hole, Massachusetts, to continue the investigation of the distribution of the tilefish which had been rediscovered along the continental shelf, south of New England.

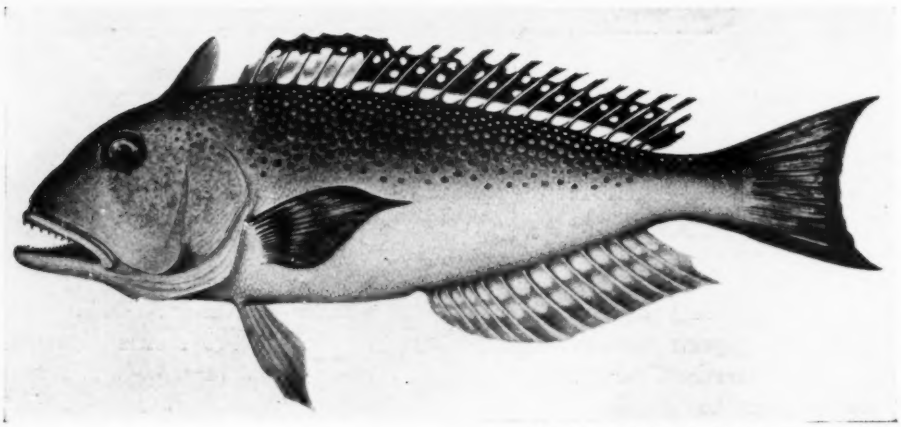
The original discovery of this fish, as far at least as any records go, occurred in May, 1879, when Captain Kirby of Gloucester, while fishing for cod and hake south of Nantucket, brought up in one catch about two thousand pounds of a strange fish, most of which were promptly thrown overboard. A few, however, were kept and cooked, and proved so palatable that Captain Kirby landed in Gloucester with about four hundred pounds of the dressed fish and sent a specimen to the United States National Museum. It was found to be a new genus and species, was given the name *Lopholatilus chamæleonticeps* (or the crested tilus with chamæleon-like head), and as it was a large beautifully colored fish of excellent food qualities, and existed in large numbers not far from the coast, steps were immediately taken to locate the fishing grounds and determine the feasibility of establishing a fishery.

From time to time during 1880 and 1881, trawls were set and fish caught,

but in March and April 1882, before very much had been ascertained about it, there occurred a catastrophic destruction of the tilefish. Vessels reported having sailed for many miles through masses of the dead fish floating at the surface, and, from accounts of various vessels, it was estimated that an area one hundred and seventy miles long and twenty-five miles wide was covered by tilefish in a dead or dying condition, and that at least 1,400,000,000 individuals had perished.

Later in the same year Professor A. E. Verrill, then in charge of the scientific exploration work of the United States Fish Commission, investigating with the ship "Fishhawk," not only was unable to find a single tilefish, but also noticed a singular absence of many species of crustaceans, mollusks, echinoderms, and other forms, which he had found plentiful the year before in the same locality. Evidently some marked and sudden change in conditions had fatally affected all these marine creatures, and, although the cause of this change has not been determined with absolute certainty, the investigations made both before and since it took place have enabled very probable conjectures to be made.

The tilefish belongs to a tropical family accustomed to warm water, and many of the sea-bottom animals found in its vicinity are also tropical or subtropical in character. It was found that the sea bottom, at and below the hundred-fathom line along the New England coast is as steep as a mountain side, and the upper portion of this slope, from sixty-five to about two hundred fathoms, is bathed by the waters of the Gulf Stream. The water here is therefore considerably warmer than that nearer inshore, and than the water which underlies it farther out. This narrow warm belt is occupied by a continuation of the southern or West Indian Gulf Stream fauna, which could not exist here if the Gulf Stream did not flow along the bottom of this area both in winter and summer. There is evidence, however, that the position of the Gulf Stream is not constant, and that it was receding offshore at the time of the tilefish disaster, leaving the subtropical sea-bot-



Courtesy of United States Bureau of Fisheries

The tilefish was discovered by a Captain Kirby, of Gloucester, while fishing for cod off Nantucket. He sent specimens to the Bureau of Fisheries at Washington, where it was pronounced a new species and named *Lopholatilus chamæleonticeps* or "the crested tilus with head like a chamæleon." The captain however christened it "tilefish" and such it has remained

tom fauna of that area in water at a lower temperature than it was able to survive. It was predicted at the time of the disappearance, that the same species would not be destroyed farther south, and would probably migrate northward and reoccupy these grounds should conditions again become favorable.

Although a search was conducted every year for the next ten years, no tilefish were discovered, but from 1889 to 1891 a series of temperature investigations made over this tract by Professor William Libbey, indicated that there was in process a definite movement of warm water toward the shore, a continuance of which would result in the rehabilitation of the tilefish in its former habitat.

In 1892 eight specimens of tilefish were obtained on the old ground by the United States Fish Commission schooner "Grampus," and from this time until 1898 small incidental catches were reported by fishing vessels every year. These seemed to indicate that the tilefish were returning, and in August, 1898, Dr. H. C. Bumpus, director of the biological laboratory of the United States Fish Commission at Woods Hole, decided to make a systematic investigation of the tilefish grounds. The "Grampus" was accordingly placed at his disposal for the purpose. This schooner was a two-masted vessel, especially built by the government for investigating the fisheries. She was about one hundred feet over all, with a draft of twelve feet. In addition to the usual cabin space, she was equipped with a small laboratory and apparatus for scientific work, including nets, dredges, and preserving materials. Three trips were made by the "Grampus," with the object of determining the abundance and area of distribution of the tilefish. One of these trips yielded 203 tilefish.. This catch, totaling more than two thousand pounds, was taken to Montauk Point and distributed to the soldiers at Camp Wickoff. Tilefish were caught at every trial during these trips, and trawls were set in water of a depth from sixty to eighty fathoms.

In August, 1899, it was decided to determine the inshore limit of the tilefish grounds. In addition to the regular crew of the vessel, four of the scientists who were spending the summer in the government laboratory were invited to make the trip, in order to make observations on the habits and anatomy of the tilefish in particular and of any other fauna that chanced our way.

Captain Hahn of the "Grampus" was an ideal commander of such an expedition; the highest type of American sea captain and a thorough gentleman. A man of perhaps forty, he had followed the sea from early boyhood, had risen through merit alone, and was known throughout New England ports as an expert navigator.

It was late afternoon when the lines were cast off, and the "Grampus" was towed out of the harbor and headed up Vineyard Sound. About nine o'clock in the evening, Gay Head light was passed, and Captain Hahn altered his course to due south. Several of us spread our mattresses on the after deck and prepared to enjoy the beauties of an August night. It was an evening not soon to be forgotten. Overhead, the sky was studded with myriads of stars; on our port were the white and red flashes of Gay Head; on our starboard, the twin lights of the Vineyard Sound Lightship. The red and green lights of passing vessels showed in the distance, while the stillness of the night was broken only by the throbbing of some tramp steamer and by the gentle swish of the water along the sides of the "Grampus." At last biological theories

had been sufficiently discussed, real stories exchanged, and all, save the watch, turned in.

The next morning all signs of land had disappeared and we were gliding over a long ocean swell before a fresh breeze. At eight o'clock, Captain Hahn took an observation. Soundings showed about fifty fathoms and the clear blue water indicated that we were near the edge of the Gulf Stream. The particular purpose of this trip was to determine how far inshore the tilefish had moved. Previous catches had been made in sixty to eighty fathoms and it had been decided to try for them in fifty to sixty fathoms.

Tilefish, like cod, halibut, and other deep-water fishes, are caught on what is called a ground-trawl line. This consists of a long heavy cord or line, one thousand feet or more in length, to which is attached, at intervals of six feet, short lines three or four feet in length with a fishhook on the end of each line. The trawl line is carefully coiled in a tub, and each hook baited as it is placed in the tub. To set a trawl, one end of the ground line is attached to a small anchor, which is lowered to the bottom by a small buoy line. To this buoy line a buoy is fastened, which floats on the surface and thus marks the position of the anchor and the beginning of the trawl line. As the anchor sinks, the ground line in the tub is carefully payed out, so as not to entangle the short baited lines. When the anchor is fastened in the bottom, one of the men rows the dory from the buoy at right angles to the current or tide and the other man pays out the trawl line from the tub. A second trawl line is fastened to the end of the first line and the process of setting continues. Thus, finally, several tubs of trawl are fastened together and stretched along the bottom, making one continuous line a mile or more in length, with a short baited line every six feet. By setting the ground line at right angles to the current the short lines float out free and do not become entangled with their neighbors. It takes an hour or two to set such a trawl and it may take three hours to haul it. For tilefish, the hooks are baited with pieces of squid or menhaden and a trawl is left down for three to eight hours.

While the sailors were setting the trawls, the "Grampus" was close-hauled and Captain Hahn jogged back and forth in their vicinity. The scientists, in the meantime, busied themselves with dip nets and towing nets, investigating the sea water, which was found to be teeming with invertebrate life. Long chains of transparent Salpa, shaped like miniature barrels, went floating by. Sometimes these would be in the form of rings.[1] Every bunch of seaweed was alive with small crabs, copepods, and other Crustacea, and often concealed fish eggs or even tropical fish themselves. Here and there porpoises broke the surface and occasionally a whale was seen spouting in the distance.

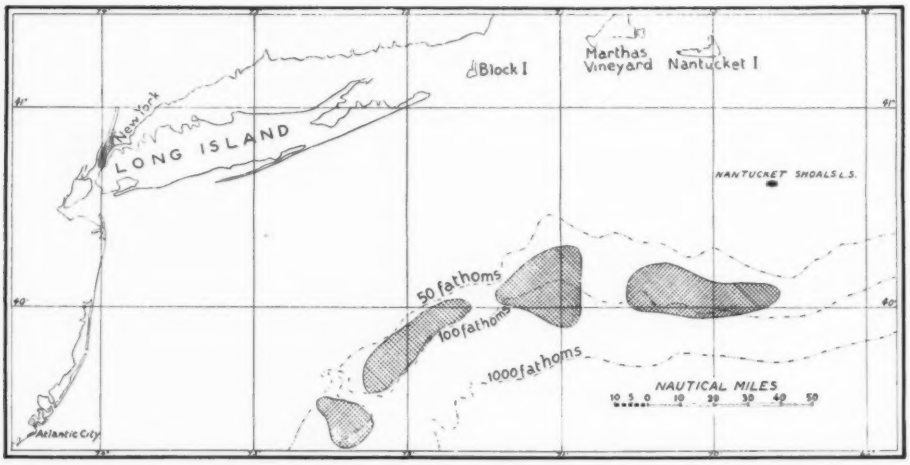
By noon the first trawl of four tubs had been set and the fishermen returned to the "Grampus." Soon after luncheon, Captain Hahn decided to haul in the trawl and the "Grampus" was sailed up to the buoy. A dory, manned by two sailors, was swung over the side and pulled away. First the buoy line was hauled in and neatly coiled in the bow: then the trawl line itself was taken in. Almost the first hook that appeared had a tilefish on it, and watching from the deck of the "Grampus," which was drifting a quarter of a mile distant, we

[1] The Salpa is one of those animals which in adult form resembles some of the lowest invertebrates, while in its embryonic form it is closely vertebrate in character.

Courtesy of the Paramount Pictures Corporation

THE HOOKS ARE BAITED WITH SQUID OR MENHADEN

Tilefish are deep-sea fishes, caught by means of a ground-trawl line. This heavy line, about half a mile long and with short bait lines every six feet, is coiled in a tub; one tub and two men are apportioned to each dory or small boat. One end of the trawl line is dropped to the sea bottom, with an anchor to hold it, and a buoy to mark the place at the surface; then, while one man rows the boat across the tide or current, the other man pays out the trawl. Several tubs of trawl are fastened together and stretched along the sea bottom. After a few hours of waiting, the dories again go out and the trawl with its catch is hauled in



Courtesy of United States Bureau of Fisheries

Map showing distribution of the tilefish grounds and the depths at which the fish is found

Courtesy of the Outlook Company

***Taking in the trawl.*— Accustomed to the pressure of the many fathoms of water under which they live, tilefish gradually become inert as they are drawn to the surface and finally float on their backs in a dying condition. One fish has just been unhooked; another is floating beside the boat**

could see fish after fish come over the side of the dory, some of them of good size. As the men took in the trawl, the dory sank lower and lower in the water, and by the time the hauling was completed, it was loaded to the gunwales. The fishermen then pulled away to the "Grampus," where we were anxiously awaiting our first glimpse of the tilefish. As the dory came alongside, we were astonished at the sight. The fish are brilliantly colored and had an iridescence almost rainbow in effect. Only a few showed any sign of life and the majority had the air bladder or portion of intestine protruding from the mouth. This is always likely to be the case with fishes that are caught from considerable depth (where pressure from the many fathoms of water is great) and is caused by the sudden release of external pressure as they are brought rapidly to the surface.

Immediately the scientists became busy. Certain specimens were dissected to show anatomy. A special study was made of the anatomy of the air bladder and samples of the gas in the air sac were taken for future analysis. The majority of the specimens were packed in ice but some found their way to the cook's galley, and that night we enjoyed our first meal of fresh tilefish. The flesh resembles cod and is very palatable.

As soon as Captain Hahn saw that we were on tilefish grounds, he decided to set a second trawl. This was set three or four miles west of the first catch.

The following day was devoted to fishing. Trawls were set in seventy fathoms, and in fifty-five fathoms and always with success. It was apparent that the tilefish had not only reëstablished itself but was abundant over a large area. The second night gave evidence of thickening weather, and the sky was overcast. About one o'clock as we lay on deck, the distant throbbing of the engine of some steamer could be heard, and soon the red and green sailing lights could be distinguished, indicating that she was headed directly for us. She came up so rapidly that Captain Hahn decided to "show her the torch." The mate climbed fifteen or twenty feet up into the rigging and lit a kerosene torch, and, as soon as the light flashed into the darkness, we noticed that the sound

On the way to the cook's galley.— The fish are bright colored and brilliantly iridescent — and taste as good as they look

of the engine ceased. The steamer, evidently a tramp, was perhaps a half mile distant. In a few minutes the engines again began to vibrate, slowly the red light disappeared, and we knew that she had altered her course. I for one breathed easier.

The next morning the weather looked threatening and Captain Hahn decided to haul the trawl that had been set

Courtesy of Paramount Pictures Corporation

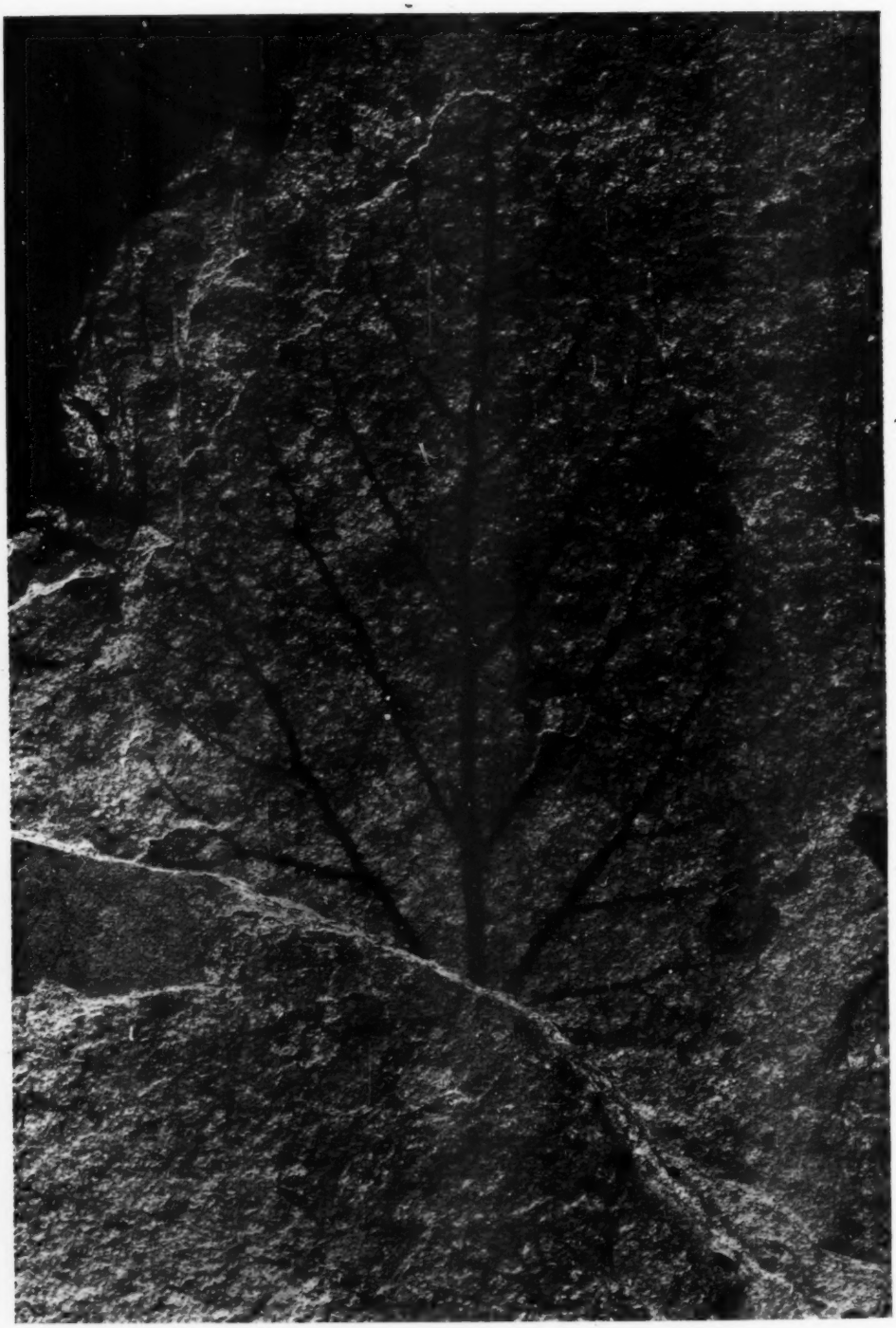
WEIGHING TILEFISH AT THE DOCK

When the day's catch has been hauled in, it is cleaned at once and packed in chopped ice in the hold. It is weighed for sale on arrival in port. Between October and June last, the markets of New York City sold 4,125,000 pounds of tilefish

the previous afternoon. Scarcely had the men begun to take it in when the wind freshened, and as the morning advanced the big ocean swells changed into whitecaps. Captain Hahn became less talkative. With one eye he watched the sails, with the other the eggshell of a dory, which appeared for a moment on the crest of a wave and then was lost to sight in the trough of the sea. We were now treated to a bit of good seamanship. As Captain Hahn saw the last of the line taken into the dory, he headed the "Grampus" directly for the little boat. It seemed to us that he would surely run it down, but so well did he know his vessel that with a turn of the wheel he brought the "Grampus" up into the wind; the two fishermen scrambled over the side and in a twinkling the dory was swung on deck. Without a minute's delay the "Grampus" was headed for home.

It was now about eleven o'clock, the wind had risen to the proportions of a gale and a drizzling rain set in. On account of the overcast sky of the preceding day, the captain had not been able to take an observation and he therefore laid his course for home by dead reckoning. He knew that we were some seventy miles off Gay Head. He made his calculation, set the log, and squared away for the fairway buoy which marks the entrance to Vineyard Sound. The course was almost due north, and the wind was southeast. The "Grampus" had on her summer set of sails, including a great balloon jib, which stretched from the peak of the topmast to the tip of the jib boom. With the wind on the starboard quarter the sails pulled to the utmost, and the "Grampus" careened with her scuppers under. It was an experience long to be remembered. The vessel would rise on the crest of a wave and would then shoot down with a mountain of water behind her. Every now and then her bow would be buried in a wave and as she rose, water would sweep back to the after deck house. Clad in oilskins but bareheaded, I clung to the rigging of the mainmast and watched the scene. The weather became thicker and thicker, and the wind continued to rise. The captain, grave but watchful, let nothing escape his eye. It was now getting dark. The reading of the log showed that he had run his distance. In the last hour we had traveled twelve knots. If he did not pick up the fairway buoy in the next five minutes, he would turn about and put to sea, for he dared not run in closer to land in this thick weather. Suddenly, the lookout shouted "Buoy dead ahead, Sir, just off the weather bow." Captain Hahn eased her off and the fairway buoy swirled by us in a boiling mass of foam. Then came the climax of the day. Just as the buoy dropped astern, there was a crash like a thunder clap close at hand, and the great balloon jib was rent from mast peak to boom and blown into many shreds. The captain brought the "Grampus" up into the wind: his orders were sharp and clear. The mate and crew leaped forward to take in the torn sail. They had it almost aboard when the ship buried her nose in a sea and the crest of a wave filled a bag of the sail. The canvas was snatched from the sailor's hand and in another instant had jerked the mate astride the rail. Another inch and he must surely have gone overboard. Again the captain shot the vessel into the wind and this time the tattered jib was made secure.

The excitement was over. Within half an hour the "Grampus" was in behind Gay Head. A thick fog had come in and we anchored for the night. The next morning, under a gentle wind, we made Woods Hole, with our cargo of fifteen hundred pounds of tilefish.



MULBERRY LEAF A MILLION YEARS OLD

About a million years ago the now nonexistent Lake Florissant occupied a position in the Rocky Mountains not far from Pike's Peak. Adjacent volcanoes showered into it clouds of fine volcanic ash, carrying down and covering up in layers innumerable plants and insects, which were later sealed up by lava deposits. The shale thus formed splits readily, revealing the flattened fossils of the ancient fauna and flora, thus providing an insight into past conditions. The mulberry leaf (*Morus symmetrica*) shown above belongs to a type still existing in our southwestern states, but now not found among the living flora of Colorado

Colorado A Million Years Ago

By T. D. A. COCKERELL

Professor of Zoölogy, University of Colorado

NO one pretends that estimates of geological time are even approximately exact; yet they are not pure guesswork. Converging evidence, derived from many different sources, leads us to the belief that we can, in a very rough and general way, calculate the passage of time represented by the different strata. It is not impossible that, in the future, our knowledge will become relatively precise, but for the present we may assume that the Florissant fossil beds are a million years old, more or less. Such an assumption, even if correct, is perhaps not particularly illuminating, for few of us have had to do with a million of anything. Perhaps the easiest way to think of it is to note that it represents five hundred times the distance of time between us, and the time of Christ. If one mile is taken as the equivalent of the passage of time since the birth of Christ, then five hundred miles will take us back to Lake Florissant and its Miocene life. The estimate of a million years is certainly not too great; the error is probably on the side of moderation.

Important discoveries do not always present dramatic elements until seen in the light of subsequent events. Dr. A. C. Peale, in the early seventies of the last century, accompanied a party of the United States Geological Survey which camped one evening in a mountain valley west of Pike's Peak. While supper was being prepared, Peale wandered around examining the rocks, and soon came upon well-preserved fossil leaves. This was the actual discovery of the Florissant shales. I did my best to get Dr. Peale to write out in detail his recollections of the occasion, but he never did so. This unexpected discovery of Tertiary fossils in the midst of a granite region interested naturalists, especially when it appeared that not only were beautifully preserved leaves to be obtained, but also numerous fossil insects, together with fishes and even birds.

In 1877, Dr. S. H. Scudder, then the greatest authority on fossil insects, spent the summer at Florissant, and obtained a very large collection. The beds proved so rich that many were attracted to them, and the total number of specimens secured mounted to many thousands. Great volumes were eventually published by the United States Geological Survey, in which Scudder described the insects and Lesquereux the plants, while Cope made the fishes known, in connection with other studies of Tertiary vertebrates.

Lesquereux died, and Scudder was stricken with paralysis before he had completed his labors. For a long time Florissant was neglected, except for occasional visits by tourists who gathered small collections of fossils. It is probable that during this period the total number of specimens taken away was not inconsiderable, but they were scattered about the country and received little scientific attention. The Hambach collection, now in the United States National Museum, was the basis of a paper on the fossil plants by Mr. W. C. G. Kirchner. A rather large collection exists in the Natural History Museum at Denver, but for the most part it remains unstudied. The Prince-

ton Expedition, of which the eminent palæontologists W. B. Scott and H. F. Osborn were members, gathered important material, part of which went to the British Museum, and was eventually studied by the present writer. Other specimens and collections exist in various places, and from time to time reach the hands of students. Unfortunately, private collectors, and even curators of museums, do not always recognize the obligation to make these precious objects serve the cause of science.

In 1905, Messrs. Henderson and Ramaley, of the University of Colorado, visited Florissant, and secured a small collection, including several new species. In 1906, arrangements were made for more extensive work, with the financial coöperation of the American Museum of Natural History, Yale University, the British Museum, and the University of Colorado. Dr. W. M. Wheeler represented the American Museum in the field, while Mr. and Mrs. Cockerell and Mr. S. A. Rohwer came from Boulder. The results were surprisingly good, and for several years expeditions from the University of Colorado, coöperating with other institutions, worked during the summer at Florissant. In 1909, Mr. George Sternberg, assisted by a couple of Boulder students, Messrs. Duce and Rusk, made a rather large collection, which went to the American Museum, and was described by the writer,[1] with the exception of a beautifully preserved geometrid moth, which remains at the American Museum undescribed.

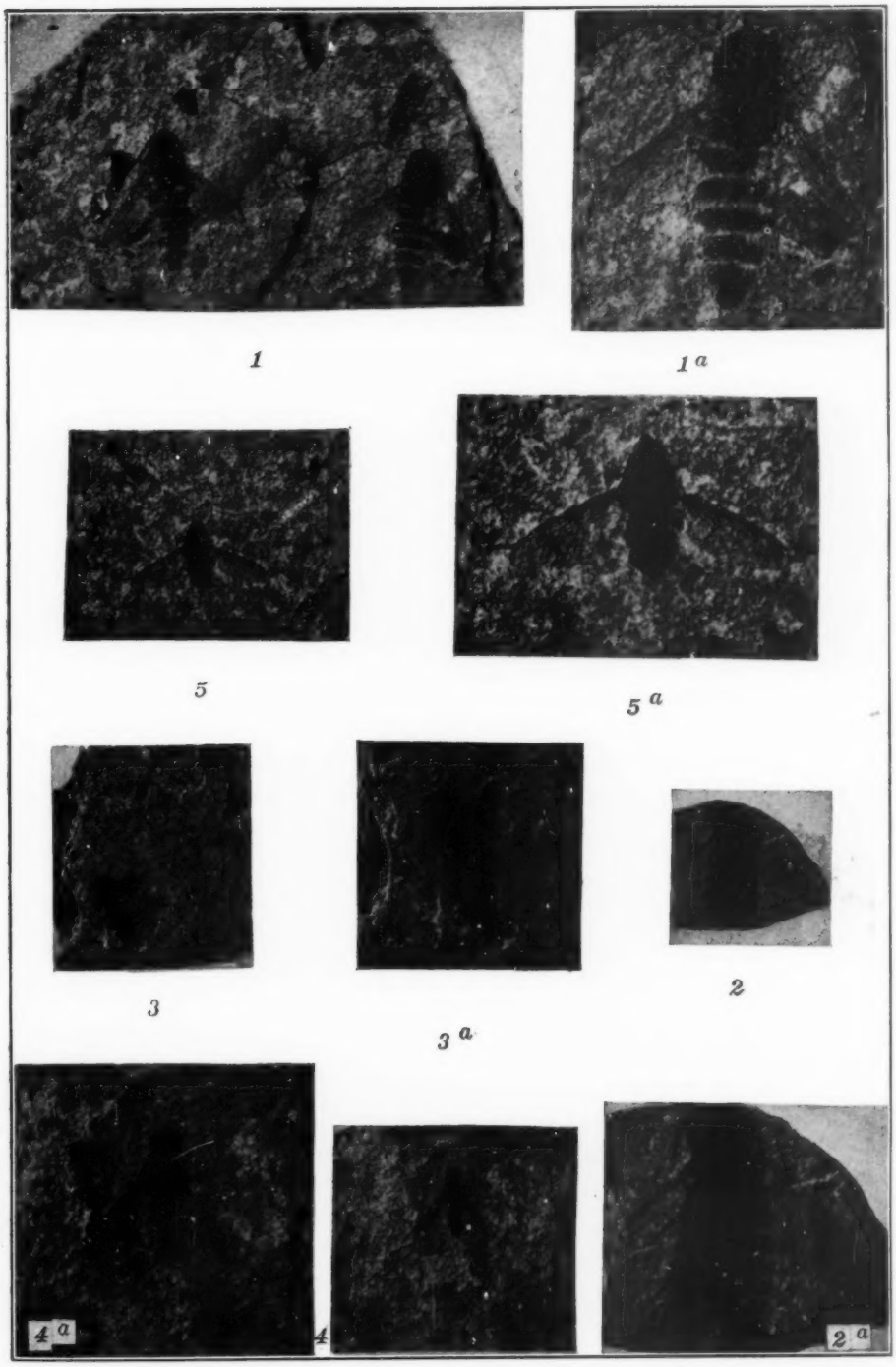
More recently the University of Colorado has ceased to send expeditions to Florissant, the available time and funds being expended in other directions; but the study of the fauna and flora has continued, the supply of materials being as yet far from exhausted.

Perhaps the best public display of Florissant fossils is at the University of Colorado, but that in the hall of geology at the American Museum of Natural History is scarcely inferior, and a good one is to be seen in the Natural History Museum in London.

The Florissant shales are derived from fine volcanic ash, which fell in numerous showers from volcanoes which were adjacent to the ancient Lake Florissant. Falling upon or being washed into the lake, this ash formed layers which covered up the numerous insects and other organisms killed by the eruptions, together with plants of all kinds, especially leaves of trees. When lava or mud flowed over these deposits, they were sealed up and compressed, forming shale which now can be split with a knife, revealing flattened but wonderfully preserved remains. After volcanic activity had ceased, and the shales had accumulated in deep layers, streams flowing over the surface began to cut out the soft rock, and eventually formed the valley we find today. It is principally along the sides of this valley that the shale is exposed, and by carefully digging it out, examining every piece minutely, collections may be made by those who are willing to take the trouble.

Those who have seen the exhibits in museums are likely to be disappointed when visiting the locality, since first-class specimens are few, and it often seems that nothing of value is being obtained to compensate for the labor in cramped and uncomfortable positions. Yet, in the hands of experts, the yield is such as it would be hard to duplicate elsewhere. Thus, in 1912, Professor H. F. Wickham, of the University of Iowa, obtained more than ninety species of beetles, of which more than forty were

[1] *Bull. Amer. Mus. Nat. Hist.*, XXVIII, pp. 275–288.



FLORISSANT FLIES

More than a thousand different species of insects and plants have been found in the Florissant shales, many of them, like the horseflies (Figs. 1 and 2 above) being very closely allied to living forms. The horses and other animals which these insects must have persecuted were, however, very different from those of today, the mammalian groups having greatly changed since the Miocene while insects and plants have remained nearly the same. Migrations that have taken place among the latter, make it possible to connect the presence or absence of certain forms with changes of land and water. In the order numbered, the flies above are *Tabanus parahippi, Tabanus hipparionis, Psilocephala hyp.gæa, Lithocosmus coquilletti* (a genus now extinct), and *Chilosia miocenica*

new, in an excavation about twenty feet long and six feet deep. The amount of shale existing is such that it can hardly be exhausted, but it is very unfortunate that inexperienced collectors throw away many valuable specimens, looking only for conspicuous ones, while from time to time very fine things are preserved by the non-scientific as curiosities and are eventually broken or lost.

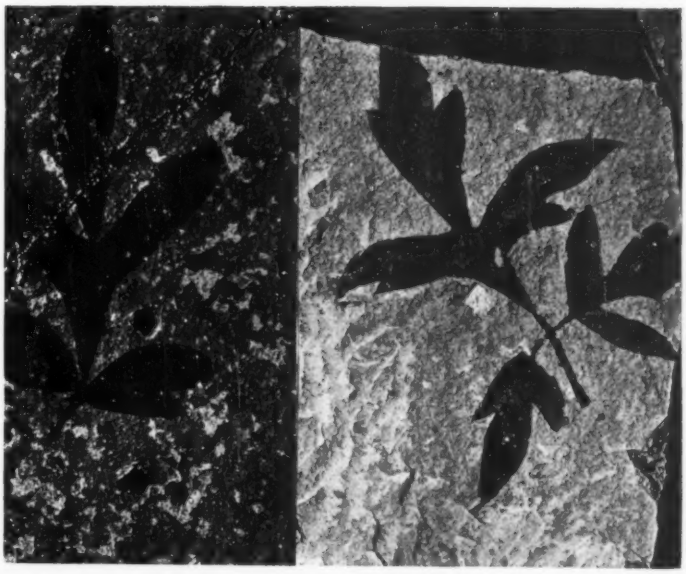
That the climate of Florissant was once both milder and moister than it is today is evidenced by the plant remains found. Fig, magnolia, elm, beech, walnut, cedar, poplar, pine, oak, giant redwood, and other trees, formed a forest of mixed elements such as cannot be found together anywhere today. The redwood, now confined to California, was once widespread over the northern hemisphere and is represented at Florissant not only by foliage but also by large silicified stumps (*Sequoia hayden*i). [See Cockerell's *Miocene Trees of the Rocky Mountains, 1909*]

Many species of Florissant insects are still known only by uniques, and in spite of the richness of the field it is impossible to have any assurance that species so represented will ever be found again. In some cases there is a not unnatural confusion of mind regarding the money value of specimens. To a non-scientific person it seems highly illogical to say that an object is in one sense of priceless value, and in another only worth ten or fifty cents. The value of a new species of fossil fly or beetle, in a money sense, is of course very small, since neither museums nor naturalists can afford to give large sums for objects which "bake no bread," and which at the time interest perhaps fewer than half a dozen persons in the world. On the other hand, such specimens form part of the material of science, and essential parts of the great structure of knowledge, and will continue

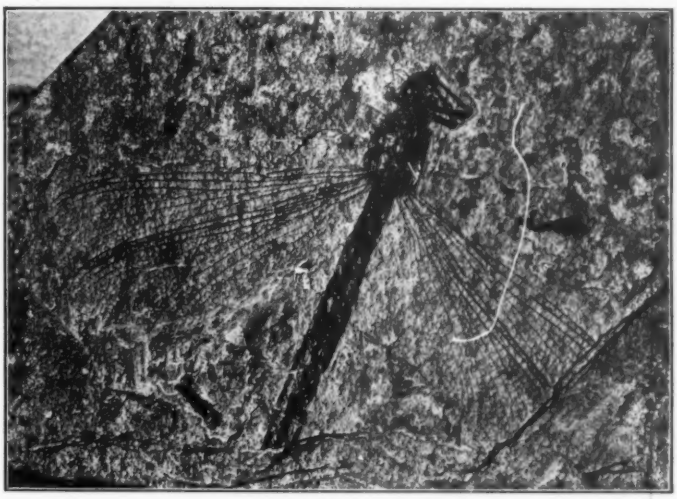
for unknown generations to tell their humble but not insignificant tale of what has been. To lose or destroy them is like removing a brick from some splendid building; the building will not fall, but the offense is intolerable.

Perhaps the greatest importance of the Florissant deposit lies in the fact that so many species (more than a thousand described) of insects and plants have been found. The great number of forms of life known enables us to reconstruct a picture of the period, and to draw conclusions from the absence as well as the presence of certain groups.

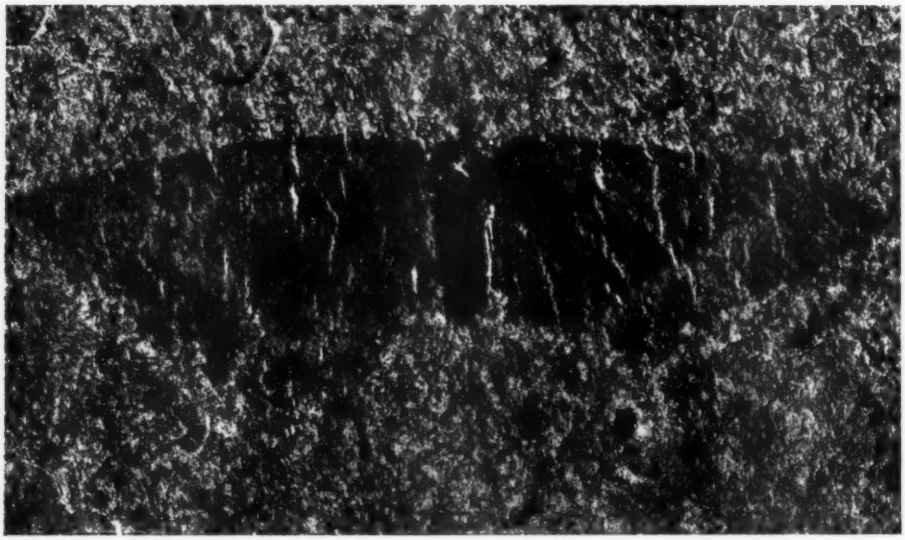
Florissant is, in effect, a sort of Miocene Pompeii, affording us an insight into the past conditions which few deposits in the whole world can give. From it, we may even reason about conditions in remote parts of the world. Thus, the presence of certain characteristic Old World forms of life suggests that land was, or had recently been, continuous between Asia and America; the absence of a distinct South American element indicates that the Isthmus of Panama was still under water. These geographical changes can be demonstrated to have occurred, using quite other evidence; and if it appears that the Florissant beds were



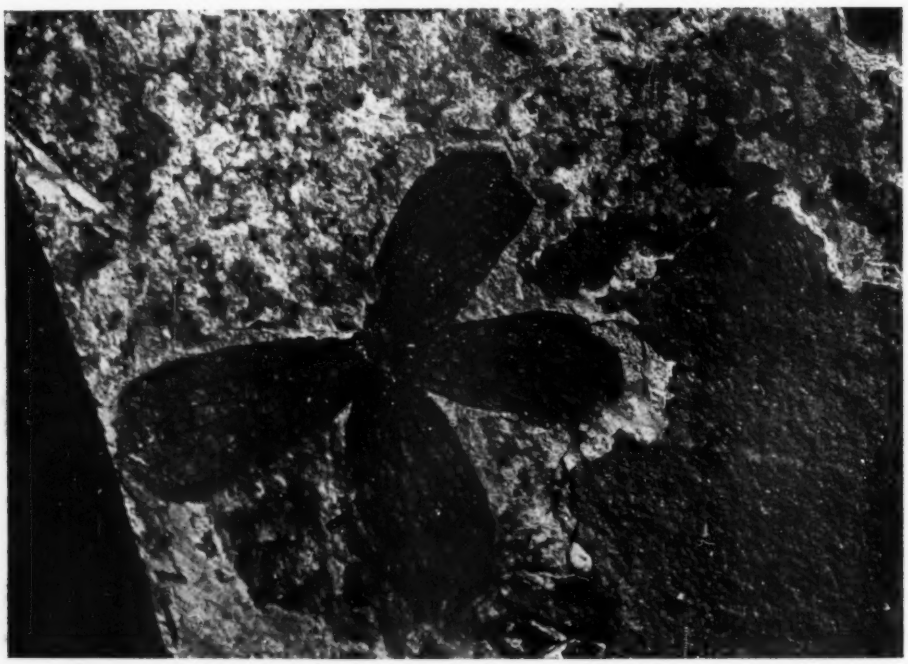
These fossil leaves are believed to belong to the family Proteaceæ, plants which today are found only in countries of the southern hemisphere. Naturalists have speculated as to land bridges across which these plants might have come, but discovery of them in the Colorado shales, showing that they once existed in the north temperate zone, has changed the nature of these speculations. The leaves above are strikingly like those of the modern greenhouse plant *Grevillea robusta*



Dragon fly (*Phenacolestes*) found in the Florissant shales, belonging to a genus now extinct



This butterfly (*Nymphalites scudderi*) lived a million years ago. Florissant is especially rich in flowers and flower-visiting insects, and is the only locality in the New World where fossil butterflies are found. Some of these show the wing markings very perfectly



Roses, leaves, ferns, grasses, even fungi and mosses, are among the smaller fossil plants found at Florissant, and flowers are abundant. This one (*Porana tenuis*) belongs to a type now found in Asia but wholly absent in America, and the finding of such Old World forms suggests that land was, or recently had been at the time the shales were laid down, continuous between Asia and America

laid down before this event, but after that, we have then a relative date to use in our studies of stratigraphy. Forward evolution among the plants and insects during the last million years or so has been extremely slow, or perhaps in most groups altogether lacking; but migrations have been many, and from these we may date our rocks and connect the presence of fossils with changes of land and water.

Among the Florissant insects, perhaps the most interesting are two species of tsetse fly (*Glossina*), a genus now wholly absent from the New World, but well known in Africa, where certain species carry disease-producing Protozoa. Sleeping sickness in man results from the bite of tsetse flies infected with a certain trypanosome. Whether the Miocene species of *Glossina* carried any organisms producing disease we cannot now determine, but it is not unlikely. Professor H. F. Osborn had written concerning the probable reasons for the extinction of so many of the large American mammals, and had cited the tsetse fly diseases in illustration of possible causes. By a curious coincidence, the tsetse fly was discovered at Florissant shortly after the publication of these suggestions, affording such measure of confirmation as could in the nature of the case be expected. The second species of fossil *Glossina*, found later, was named *G. osborni* in commemoration of this coincidence.

Florissant is famous for its fossil flowers, and equally for the flower-visiting insects, bees and butterflies. All the New World fossil butterflies are from Florissant, and some of them show the bands or spots upon the wings very perfectly. The finest of all was obtained by Scudder, and is in the Museum of Comparative Zoölogy at Harvard University. A very good one, lacking the lower wings, was found by Mrs. Cockerell. Moths, for some reason not explained, are extremely scarce, and usually poorly preserved. A very good caterpillar has been found. Beetles are very abundant, and including those lately published by Professor Wickham now number five hundred and fifteen. To these will be added thirty-nine species of Elateridæ, which Professor Wickham has described in manuscript. While the beetle fauna shows much in common with that of today, the absence of certain groups is no less remarkable than the great abundance of others, especially of the weevils.

The plants, better than the insects, indicate a milder climate than exists in Colorado today, and especially a moister one. There were no palms, but great redwoods mingled with figs, magnolias, *Ailanthus*, *Sapindus*, elm, beech, walnut, chestnut, incense cedar, maples, poplars, pines, and oaks; a mixed forest consisting of elements which cannot be found together in any one place today. Nearly all the plants are very closely allied to living ones, in some cases so closely, that but for the interval of time we might well regard them as mere varieties. Several species are said to belong to the family Proteaceæ, and although this reference has been disputed, it appears to be correct. Certainly they are quite unlike any components of the present North American flora, while some of them, at least, are extraordinarily like certain proteaceous species.

On one occasion I led my wife up to some young plants of *Grevillea robusta* in a greenhouse, and asked without any explanation, "Where have you seen that?" The reply came instantly: "In the shale." She did not know why I asked, nor what the plants were; the impression made by the cut of the leaves was naïve and immediate. The fossil

plants having the cut of *Grevillea* are currently referred to *Lomatia*, but they might as well be placed in the former genus. This case is of unusual interest because the Proteaceæ are today southern plants, scattered through the countries of the southern hemisphere, where they lead naturalists to imagine land bridges across which they might have come. Proof that they once abounded in the north temperate zone puts an entirely new face on these speculations.

Among the smaller plants at Florissant are roses, including a well-preserved rosebud, ferns, grasses, and even fungi and mosses. A fruiting moss which we found was transmitted to Mrs. N. L. Britton, and is now at the New York Botanical Garden. A small liverwort, also sent to the New York Botanical Garden, still awaits description.

The weak point in the Florissant collection, so far, lies in the inadequate representation of organisms other than plants and insects. Scudder described many spiders, but they were mostly poorly preserved. Other spiders are now in the hands of Dr. Alexander Petrunkevitch for description. A single millipede was published by the writer, and a specimen was handed to Mr. R. W. Miner of the American Museum for description, but has not yet been published. No centipedes have been found, and it is extraordinary that a single ostracod represents the Crustacea. The mollusks number seven, two only being land snails. There are ten fishes, including an extinct genus of especial interest. Two birds have been described, and another is in the possession of Dr. J. E. Cutler of Denver University, and will shortly be made known. Feathers are quite common.

The only trace of Florissant mammals, as yet, consists of some minute and fragmentary teeth. No reptile or amphibian has been seen, although we have an object which may possibly be a turtle's flattened egg. A general summary of the fauna was published in the *American Journal of Science*, 1913, (p. 498), but rather numerous additions have since been made, and about sixty species of insects (described by Wickham and the writer), and several plants (described by Knowlton) await publication. A summary of the flora was given in *Bulletin Amer. Mus. Nat. Hist.*, Vol. XXIV, February, 1908.

A new species of rose (*Rosa wilmattæ*) from the shales of Florissant

The Whale House of the Chilkat

By GEORGE T. EMMONS

AN ACCOUNT OF THE CHILKAT INDIANS OF ALASKA, AND THE MOST IMPORTANT OF THEIR ANCIENT COMMUNAL HOUSES

The material here presented has been gathered from the most reliable native sources throughout a period of twenty-five years of intimate personal acquaintance and association with the Tlingit, and treats of their past, before the exodus from their old villages to the mining camps and salmon canneries of the white man so reduced their numbers that communal life in the large old houses, upon which their social customs and practices depended, was rendered impossible, and the seed of a new life was sown.— GEORGE T. EMMONS.

UPON the discovery of the Northwest Coast of America, the Tlingit were found in possession of southeastern Alaska, with the exception possibly of the southernmost portion of Prince of Wales Island, which had been wrested from them by invading Haida from Masset on the Queen Charlotte Islands during the latter half of the eighteenth century. From the testimony of the early explorers, this occupation seems to have been of sufficient age to have developed a racial type, speaking the same tongue, acknowledging established laws, and bound by like conventions. What knowledge we can gather of their origin and early life from their family traditions, songs, and geographical names, although fragmentary and vague, tells consistently of a uniform northward migration by water, along the coast and through the inland channels from the Tsimshian peninsula and Prince of Wales Island, which was constantly augmented by parties of Interior people descending the greater rivers to the sea.

The social organization of the Tlingit is founded on matriarchy, or descent through the mother, and is dependent upon two parties, the members of each of which may not marry among themselves, but the two parties intermarry and supplement each other upon the many ceremonial occasions that mark their intercourse.

The two parties are subdivided into fifty-six existing families or clans, founded on blood relationship and absolutely independent in government, succession, inheritance, and territory. Within the family there is a well-defined aristocracy, wholly dependent upon birth, from which the chiefs are chosen; an intermediate class consisting of those who have forced themselves to the front, through wealth, character, or artistic ability; and the poorer people. In earlier days there were many slaves who had no recognized rights.

Geographically considered, there are sixteen tribal divisions known as "kwans," a contraction of *ka* (man) and *an* (land lived on or claimed). Of these several tribes the Chilkat-kwan has been the most prominent since our acquaintance with Alaska. The relative importance of a primitive people is measured by conditions of food supply and other natural resources. The commanding position of the Chilkat, at the head of the inland channels controlling the mountain passes to the interior, gave them the monopoly of the fur trade of the upper Yukon Valley, and the placer copper fields of the White River region. These products, unknown to the coastal area, were economically important in primi-

Photograph copyrighted by Winter and Pond

CHILKAT CHIEFS OF THE RAVEN CLAN

The chiefs are chosen from a well-defined aristocracy dependent upon birth, and to the chiefs and housemasters belongs the privilege of naming the communal houses on the occasion of their dedication. A name once given belongs not only to the particular house but also to all future houses built on that site. At the great potlatch, or feast of dedication, the head chief welcomes his guests, wearing the Raven hat, emblematic of his family totem or crest

THE COUNTRY OF THE CHILKAT, LYNN CANAL, ALASKA

Davidson Glacier, shown above, is near the head of Lynn Canal, Alaska, about which the Chilkat tribe of the Tlingit have their principal villages. Two rivers, flowing from lakes, provide a limitless supply of salmon, sea fish and game; and exhaustless berry patches on the mountain side make living easy. Also, command of the mountain passes to the interior gives this tribe importance among the Tlingit

tive days, and after the advent of Europeans the increased demand for furs, and their greater value, made this trade even more lucrative.

The Tlingit were a canoe people and might be termed semi-nomadic, as they were on their hunting grounds in the early spring and late fall, while the summer season was spent in the fishing camps by the salmon streams; but notwithstanding these long absences they built substantial villages, where, except for social activities, they spent the winter in comparative idleness.

As they looked to the sea for their principal food supply, their villages were directly on the shore just above the high-water mark, in sheltered coves where they could launch their canoes and land in any weather and at any stage of the tide. But the Chilkat, differing from all of the other Tlingit, lived just beyond the open water in a rather restricted territory on rivers that were veritable storehouses of food, bringing abundance of fish life to their very doors and so permitting them to remain at home throughout the year, except when on their trading trips to the interior, which gave their habitations a more permanent character, and contributed to the unity of communal life.

Of the four principal old villages, all of which have survived the ravages of constant strife and the still more deadly by-products of civilization — liquor and disease —Klukwan (mother town) has always held the first place in size, wealth, and the character of its people. It retained its supremacy long after the larger of the more southern coast villages had gone to decay, as its more interior and isolated position, and the independent and aggressive reputation of its population, kept white traders at a distance. Klukwan lies at the edge of a gradual slope on the north bank of the Chilkat, twenty miles from its mouth. where the swift current concentrated in a single channel forms a strong eddy that permits the landing of canoes at any stage of the river.

Of the five totemic families that form the Chilkat-kwan, four are resident here. Of these, the Kon-nuh-ta-di, the sole representative of the Raven party, is the one with which this paper deals. Their legendary history, so imaginary and interesting, is closely associated with the wanderings and antics of "Yehlh," the Raven creator, while the earliest family traditions are centered about the south and west coasts of the Prince of Wales and contiguous islands, where, at an early period, they must have lived.

Their personal names frequently refer to the Raven, their most honored crest, as they claim to be the first family of this phratry, and it is conspicuously displayed on the totemic headdress and ceremonial paraphernalia. They claim and use a great many other emblems as the whale, frog, woodworm, silver salmon, hawk, owl, moon, and starfish. In their house carvings and paintings they illustrate the hero deeds and conquests of their ancestors in early struggles with mythical animals and supernatural beings.

When I first visited Klukwan in 1885, the large old communal houses of the Kon-nuh-ta-di were still standing, the principal one of which, that of the hereditary chief, "Yough-hit," (Whale house), was in the last stages of decay and uninhabitable, although the interior fittings were intact and it was still used upon festival occasions. It was unquestionably the most widely known and elaborately ornamented house, not only at Chilkat, but in Alaska. It occupied the site of much older houses and, it is claimed, much larger ones. It is said to have been built by Kate-tsu about,

The Whale House of the Chilkat in 1885, uninhabitable now but with interior fittings intact and still used on festival occasions. In the old days these communal houses, made of heavy timbers split from the giant spruces, were fortresses of defense, with narrow doorways for entrance and the smoke hole in the roof for only light and ventilation. The poorest families of the chief's following were allotted the sleeping spaces nearest the door, the family of the chief himself occupying the rear of the house. The advent of the white man with his mining camps and canneries has done away with the communal life, and the old houses have for the most part disappeared or been modernized

In 1882, the Chilkat were still a comparatively primitive people, practising ancestor worship, cremating the dead, dominated by superstitions and by the shamans or medicine men, who mediated between them and the spirits. The houses of the dead stood in the rear of the rows of dwelling houses and beside them were the cremation grounds, strewn with charred logs and partly burnt funeral pyres. The shamans' dead houses were apart from the others, hidden in the cottonwood groves and guarded by elaborately carved spirit figures and canoes

or prior to, 1835, and stood in the middle of the village. It represented the best type of Tlingit architecture, a broad low structure of heavy hewn spruce timbers, with noticeably high corner posts, that gave it a degree of character wholly wanting in the larger houses of the Vancouver Island people. It faced the river with a frontage of forty-nine feet ten inches and a depth of fifty-three feet — approximately the proportions of Tlingit houses large and small. Each of these old houses formed a solid structure, the frame and planking supporting each other without the use of spikes. The doorway, which was the only opening in the walls, was approached by two steps, more than three feet above the ground. It was narrow and low as a defensive measure, so that but one could enter at a time, and then only in a stooping posture equally impossible for attack or defense. The roof covering consisted of a confusion of overlapping spruce boards and slabs of bark, held down originally by smaller tree trunks extending the depth of the structure and kept in place by heavy boulders at the ends. The smoke hole in the center of the roof, which both lighted and ventilated the interior, had been protected by a movable shutter balanced on a cross bar resting on two supports so that it could be shifted to either side as desired.

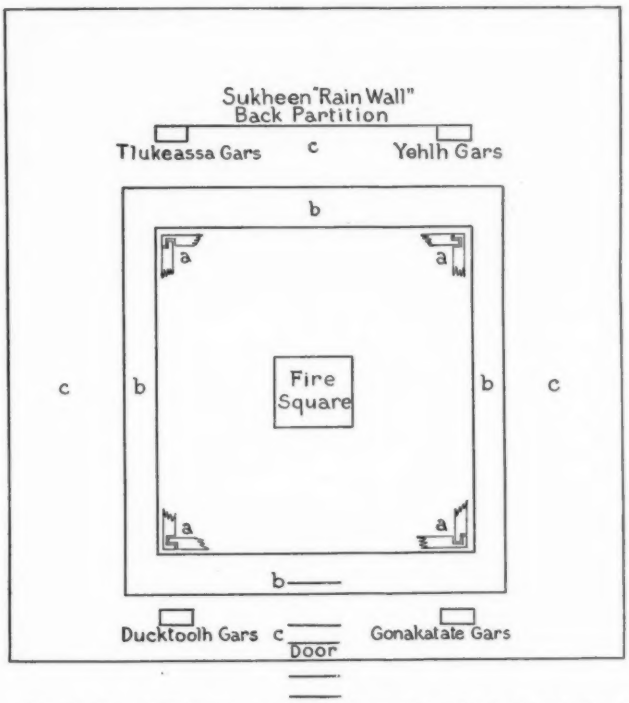
The interior formed an excavation four feet nine inches below the ground level, with two receding steplike platforms. The lower square floor space, twenty-six feet by twenty-six feet nine inches, constituted the general living and working room common to all, except that portion in the rear and opposite the entrance, which was reserved for the use of the house chief, his immediate family, and most distinguished guests. This was the place of honor in all Tlingit houses upon all occasions, ceremonial or otherwise. The flooring, of heavy, split, smoothed planks of varying widths, extended around a central graveled fire-place six feet by six feet and a half, where all of the cooking was done over a wood fire which also heated the house in winter. In front of and a little to the right of the fire space, was a small cellar-like apartment entered by a small trap door in the floor barely large enough to admit a person. This was used as a steam bath, by heating boulders in the fire, dropping them on the floor below with split wood tongs, and pouring water upon them to generate vapor —

Old house in Klukwan on the Chilkat River. Klukwan was the most important of the Chilkat villages and retained its character long after those farther south had fallen into decay

whereupon the bather entered and the opening was covered over.

The first platform, extending around the main floor at an elevation of two and three-fourths feet, comparatively narrow, with a width of two and one-half feet along the sides, and slightly more at the ends, served both as a step, and as a lounging place in the daytime, and that part of it in front, broken by the steps descending from the doorway, was utilized for firewood, fresh game, fish, water baskets, and such larger household articles and implements as were in general use. The retaining walls of this platform consisted of four heavy hewn spruce timbers approximately twenty-seven feet long, three feet wide, and five inches thick, and so fitted with mortise and tenon at opposite ends that they supported one another without artificial fastenings. The faces of these timbers were beautifully finished in the finest adze work, and those on either side and at the back were carved in low relief to represent a remarkable extended figure, neither wholly human nor animal, with widely outstretched arms and legs, painted in red.

The upper and broader platform, rising two feet above that below, was at the ground level, and was floored with heavy planks. This platform constituted the sleeping place of the inmates. Each family occupied a certain space according to number and relative importance, the poorer members being nearer the door. The spaces were separated from one another by walls of chests, baskets, and bundles, containing the family wealth in skins, blankets, clothing, ceremonial paraphernalia, and food products. On the walls hung weapons, traps, snares, and hunting gear. Cedar-bark mats covered the floor, over which was laid the bedding consisting of pelts of the caribou, mountain sheep, goat, or bear, and blankets of lynx, fox, and squirrel, which in the daytime were ordinarily rolled up for economy of space. Sometimes these chambers were partly enclosed by skins or old canoe sails. The back compartment occupying the space between the two near interior posts was partitioned off by a carved wood screen. This was the chamber of the chief and his immediate family.



Ground plan of Whale House. In size it was forty-nine feet, ten inches in front, by fifty-three feet deep. At *a* is shown how the retaining timbers forming the walls of both platforms are grooved and fitted at the corners to support one another. ***From a plan drawn by the author***

At the level of this upper platform, firmly imbedded in the ground, equidistant from the sides and nearer the front than the back wall, were four vertical elaborately carved posts or "gars," nine feet three inches high and two feet six inches wide, which supported the roof structure.

The carved interior post to the right of the doorway entering was known as Gonakatate-Gars and told a story of Yehlh, the Raven.

Gonakatate was believed to be a great sea monster, half animal and half fish, variously represented according to the imagination of the artist, but generally shown with fore feet, a characteristic dorsal fin, and the tail of a fish.

The principal figure (see color plate) extending from near the top to the bottom of the post, represents this monster holding a whale by the flipper with the tail in its mouth and the head between the hind feet, for the Gonakatate is believed to capture and eat whales. The figure of a woman on the back of the whale is called Stah-ka-dee-Shawut, a family name which serves to mark the locality.

In the blowhole of the whale is the head of the Raven, the significant feature of the whole carving.

The story of the Gonakatate-Gars is as follows:— During the wanderings of Yehlh, the Raven, along the coast of Alaska, he saw a whale blowing far out to sea. He had neither spear nor line; only his fire bag of flint and stone and tinder, so when it came up to breathe he flew into the blowhole of the whale and made a fire in its stomach that soon killed it. When the whale floated ashore, the blowhole had partly closed and he could only get his head out. He therefore began to sing in a loud voice, which brought all the villagers to the scene, and when they cut open the blowhole the raven flew out.

When the people had cut up the whale and tried out the blubber into grease, the Raven returned in human form and asked them how they got the whale, and if they had heard singing within, for he told them that long ago this had happened in his country and all of those who ate the grease had died. This so frightened the people that they left the grease boxes on the shore and returned to the village, when the Raven sat down and ate all the grease they had prepared.

The carved interior post, to the left of the doorway entering, (see color plate) was named Duck-toolh-Gars, and illustrates a hero tale of the family that occurred before their northern migration.

The human figure represents Duck-toolh tearing the sea lion in two. The head at the base symbolizes the rock island on which the sea lion hauled, when this incident took place. The head of Duck-toolh is wrapped around with sea lion intestines and is ornamented with human hair hanging down over the face. The sea lion forms the central figure; the protruding tongue indicates death, as the body is split in half. The fore flippers are parallel with the body, under the man's forearms, and the back flippers rest on his shoulders.

The villagers depended largely upon the flesh of the sea lion for food, its hide was used for armor and other economic purposes, while the whisker bristles were greatly prized for the crown of the ceremonial headdress.

These animals were found in great numbers on a rocky island far to seaward, but the ocean passage in the frail canoes was very dangerous and with primitive spears and clubs it took courage and strength to succeed in the hunt, and so the people prepared themselves for the undertaking by much exercise, and hardened their bodies by sea bathing in the early morning throughout the winter. But Duck-toolh seemingly practised none of these things, he slept late and although of great size was looked upon as lazy and weak until he became the laughing stock even of the children. But he was only shamming, and after the others had gone to bed he bathed and exercised alone. One night a heavily-built man arose out of the sea, and wrestling with Duck-toolh, imparted to him his own strength. Next day Duck-toolh went hunting sea lions with Kash-ka-di, who boasted of his strength and what he would do and ridiculed Duck-toolh.

When they reached the rocks Kash-ka-di jumped out and grabbing a great sea lion by its hind flippers tried to tear it in two, but he was thrown high in the air and killed on the rocks. Then Duck-toolh laughed and grabbed the sea lion and tore it apart, beat

CEREMONIAL WOODWORM DISH IN THE WHALE HOUSE

Closely associated with the Whale House, and in the keeping of the chief, were many ceremonial objects in crest form exhibited only on important occasions. Prominent among these was a great wooden feast dish known as "tluke-hotsick" (woodworm dish), hollowed out of a tree trunk, carved and painted to represent a woodworm, and inlaid with opercula along the upper edge. As a crest object this tells the same story as the carved interior house post. The picture shows the dish in its position in the house in front of the decorative screen before the chief's apartment

the brains out of the smaller ones, and for some unknown reason he wound the intestines of the animals around his head. Then they loaded the canoe with the carcasses and returned home and everyone knew that Duck-toolh was strength and he became a very powerful and wealthy man.

The carved post on the right of the ornamental screen was named "Yehlh-Gars" or Raven Post, and told the story of the capture of "Ta," the king salmon.

The main figure shows the Raven in human form holding a head with a projecting blade-like tongue, which is known as "Tsu-hootar," jade adze. At the bottom is the head of a fish which should have been that of the king salmon, but through a mistake of the carver it resembles more nearly that of the sculpin. Coming out of the mouth of the Raven is a bird form called "Tu-kwut-lah-Yehlh," or Telling-lies-Raven, which symbolizes the lies the Raven told to the little birds mentioned in the story.

Many of the myths relative to the wanderings of the Raven, represent him as always hungry, unscrupulous, and deceptive. One day Yehlh happened to be on the seashore near Dry Bay and very hungry. He saw a king salmon jumping, but he had neither canoe, spear nor line. He accordingly disguised himself with an old hat, mat, and eagle skin, found near by, and, taking in his hand a jade adze, "tsu-hootar," he sat down near the water and said to the salmon, "Tsu-hootar is calling you bad names, and says that you are afraid to come up to the shore." The salmon, enraged, came to the shore and was killed by Yehlh, who then kindled a fire and prepared the fish for cooking. Many small birds came around, hoping for a share of the feast; Yehlh sent them off to gather cabbage leaves to wrap the fish in, and while they were away he cooked and ate all the fish, covered the bones with the fire, and told the birds on their return that the fire had eaten the flesh.

Then all of the birds felt very bad, the little chickadee cried bitterly and, continually wiping its eyes with its feet, wore away the feathers, which ever after showed a white stripe from the corners down. The blue jay was so angry that he tied up the feathers on top of his head which have ever since formed a crest, for when the Tlingit are angry they tie the front hair up in a knot; while the robin in his grief sat too close to the fire and burned his breast red.

The carved post on the left of the ornamental screen was named "Thluke-ass-a-Gars" or Woodworm Post.

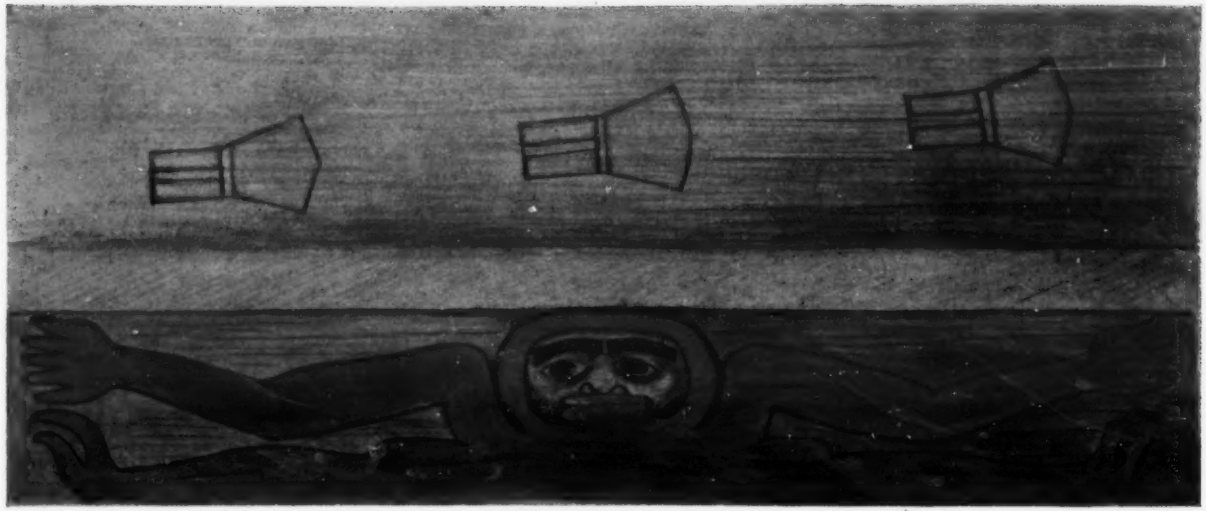
The large upper figure represents Ka-kutch-an, the girl who fondled the woodworm, which was afterward killed by her family and which she died mourning. Over her head are two woodworms whose heads form her ears. Beneath is shown a frog in the bill of a crane. The whole post symbolizes the tree in which the woodworm lives, the crane lights on the outer surface and the frog lives underneath among the roots.

Members of the Tlow-on-we-ga-dee family display the tail of the worm on their dance dress and pipes, as they attacked that part of it, while the Kon-nuh-ta-di display the whole worm figure, as they killed the head which was the most important part.

In 1899, this house and "Yehlh-hit," or Raven House, adjoining were torn down and preparations for the erection of new buildings were gotten under way, and in the winter of 1901, after the walls were up and the roof on, a great potlatch was given by the Kon-nuh-ta-di, to the three Wolf families of the opposite phratry in the tribe, and the Ka-gwan-tan of Sitka, in which over ten thousand dollars in property, food, and money were distributed. The head chief of the family, master of the Whale House, "Yehlh-gu ou," or Raven's slave, welcomed his guests upon landing, wearing the Raven hat. The new house, although modern in form and of two stories, took the old name, and it stands today windowless and doorless, the interior grown up in weeds, a monument of the last great potlatch of the Chilkat, as the chief died soon afterward and his successor has neither the means to finish it nor the desire to live in it, and the elaborate carvings have never been placed but are stored and will probably so remain.

HERO TALES TOLD IN CARVED WOOD

Within the Whale House, four posts, carved in red cedar by a Tsimshian Indian, support the heavy longitudinal beams of the roof. The Gonakatate post, or "gars" (left), represents the mythical sea monster supposed to capture and eat whales, and to bring good fortune to all who see it. It tells the story of Yehlh, the Raven. Duck-toolh-Gars (right) represents the hero Duck-toolh, or "Black-skin" (who typifies strength), rending the sea lion



INTERIOR DECORATION OF THE WHALE HOUSE

Two platforms extended around the main floor of the Whale House. The lower one, forming a step to that above, had its supporting timbers carved in low relief. The curious extended figure represented is said to symbolize the highest heaven, where those went who were killed in war or met violent deaths—and are seen at play in the Aurora Borealis. On the carefully adzed face of the upper platform are three representations of the hammered copper plate "Tinneh," an important feature of the ceremonial life of the Northwest Coast and the most valued of possessions. One of the names of the house chief was Tinneh-sarta, "Keeper of the copper"

THE SCREEN BEFORE THE CHAMBER OF THE CHIEF

This is probably the finest example of native art in Alaska. The chief's apartment in the rear of the Whale House was partitioned off by a screen, twenty feet long by nine and a half feet high, extending between the two rear carved posts supporting the roof. The round hole in the screen, over which hung a dressed goat or caribou skin, forms the only entry to the chief's apartment. This screen, called Su-kheen, or "Rain wall," was elaborately carved and painted to represent the rain spirit, symbolized by a great central figure with outstretched arms. The small crouching figures in the border around the sides and top, known as Su-con-nutchee, or "Raindrops splash up," represent the splashing of the falling drops after striking the ground

YEHLH-GARS AND TLUKE-ASS-A-GARS

These are the house posts on either side of the decorative screen in the rear of the Whale House. Yehlh-Gars (left) tells the story of Yehlh, the Raven, and the king salmon; and Tluke-ass ı-Gars (right) illustrates the story of the woodworm crest of the Chilkat

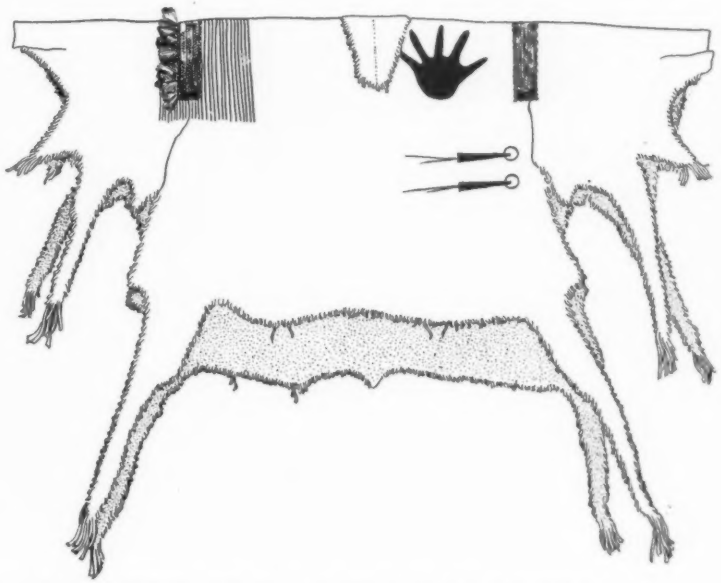
A Suggested Study of Costumes

By CLARK WISSLER

THE exhibits in the American Indian halls are now so systematic and extensive that the more serious minded visitor may find an unsuspected number of fascinating subjects for inquiry. Take, for example, the very common and homely matter of clothing. In the hall for the Plains Indians, in the cases for the Dakota (Sioux) tribes, are a number of handsome shirts for men. In the wall case adjoining the Cree collection is a very old shirt of this type, collected in 1838. On examination we find it to be made of two whole deerskins, so cut as to use all of the material with very little trimming. The shape of a skin as taken by the Indian is shown on page 466, and also the lines for cutting a shirt pattern. The next sketch shows how these pieces are fitted together to form the shirt. One must concede that the Indian women had developed a most systematic procedure and one that shows great economy of labor and materials.

There are many other equally meritorious tricks of the pattern that we cannot note here. A point of more general interest and significance is the fact that the peculiar contour of the sleeves and the skirt, which must at first impress one as a monstrosity of style, is wholly determined by the natural form of the deerskin. Thus, the long streamers at the sides are the deer's hind legs while those of the sleeve are the fore legs. On some shirts the pendent tail forms a center ornament to the skirt.

Perhaps we have here a principle of primitive tailoring that applies to other garments. For example, the women of the Plains wear a long skin dress as may be seen on the figures in the hall.* When we examine these dresses we find them made of two entire deerskins as shown in the sketch, but now the tails are at the top, the neck at the bottom. The bottom of the skirt thus has a peculiar contour, trailing sides and a center piece. In the older specimens the lines follow closely the natural form of the



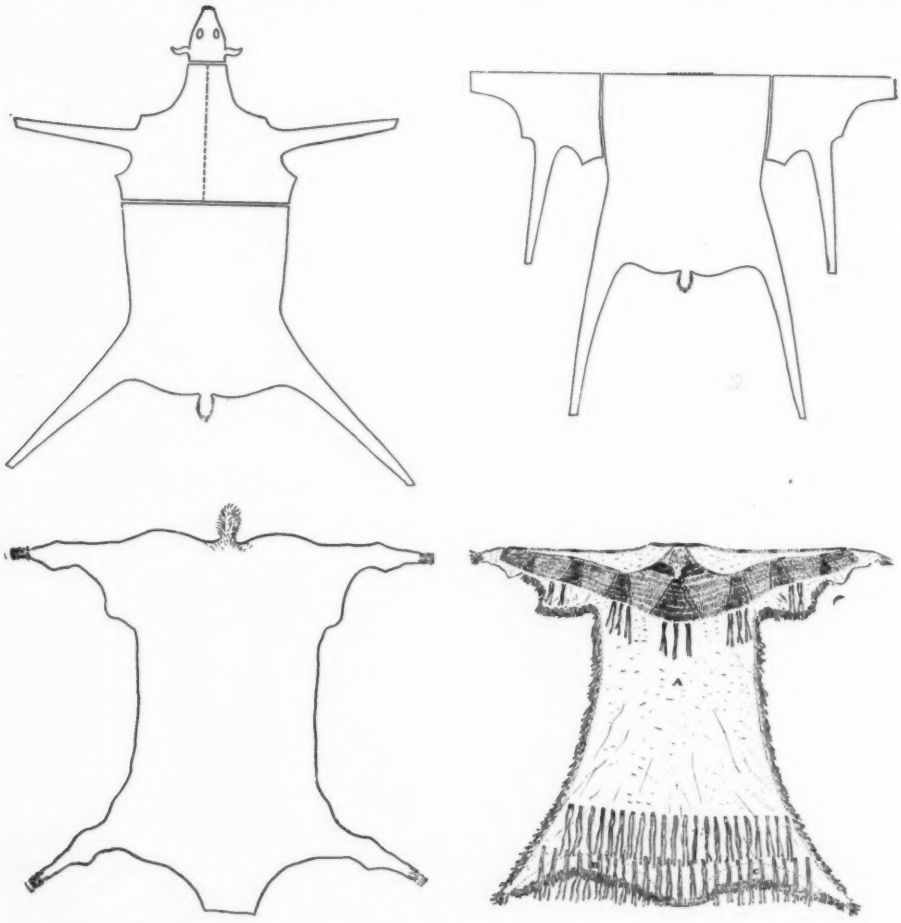
Indian shirt made from two deerskins. Compare with pattern on next page. This drawing is from a specimen collected in 1838

skin but in the newer ones the curves are rounded off.

Then if we pass out to the Woodland hall to the Indians of the East we find a peculiar cloth skirt, technically known as the Algonkin slit skirt. These Indians have been in contact with civilization so long that cloth garments alone are found in our collections but this slit skirt has two peculiar trailing pieces at the side. Now, if one took a deerskin and wrapped it around the waist, the head and neck ends would be brought together on the side and one hind and one fore leg would trail. Though we cannot be absolutely sure, this seems the most likely origin of this pattern.

We may then formulate a principle that the present styles of shirt and skirt among the Plains, and possibly among the Woodland tribes also, grew naturally out of the form of the material used, and were not creations of the imagination.

We may go farther afield to the South American hall where we find the shirts, or ponchos, of a prehistoric people.



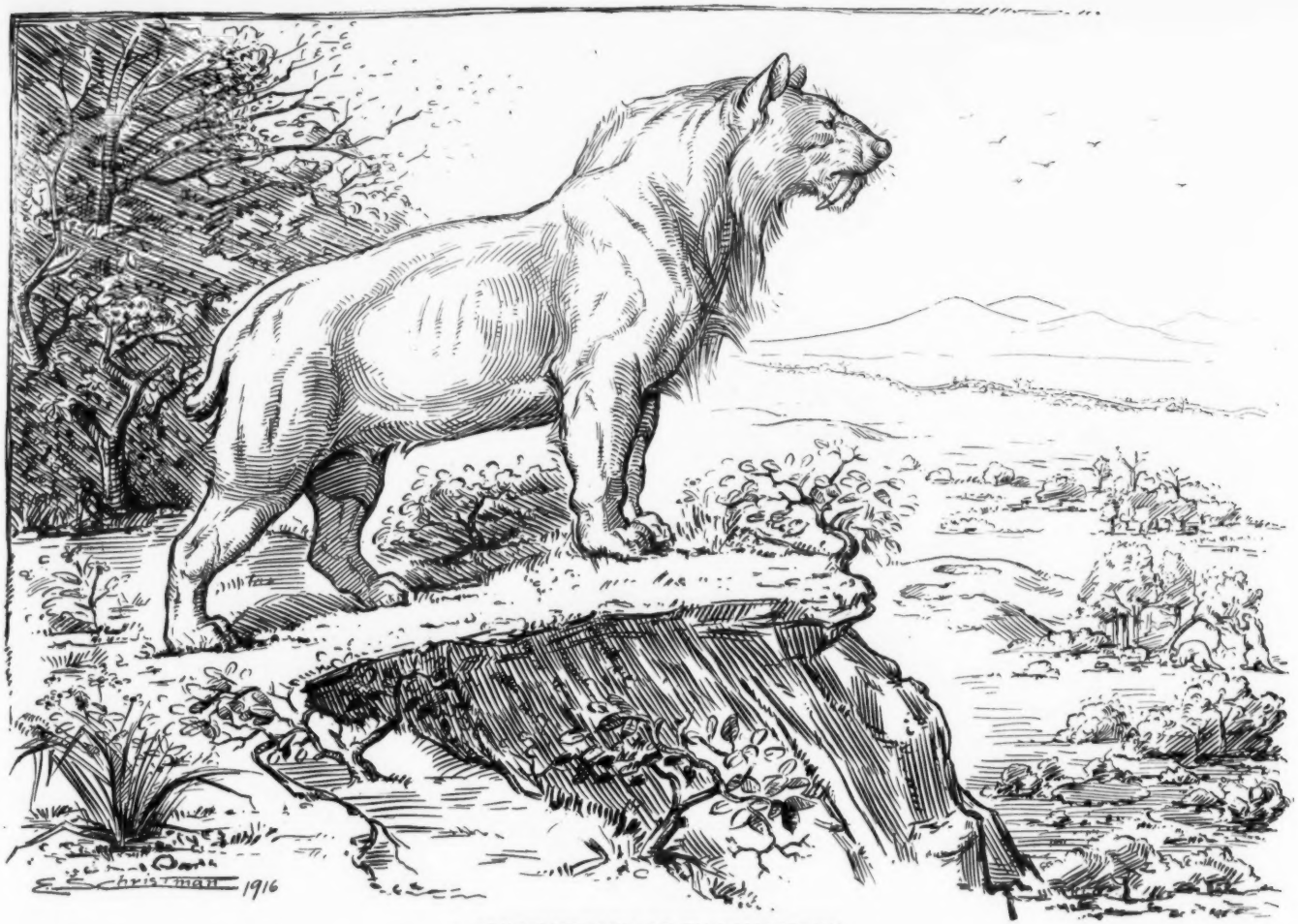
To make a man's shirt of the poncho type two skins are cut as in the one above (at the left). The two hind portions with tail attached, form the body of the shirt, and each sleeve is made by folding the upper portion of one of the skins as indicated by the dotted line

In the Plains area, two skins are put together to make a woman's shirt, but the tail is at the top and the skins are not cut (see lower figure at the left). The tail end of the skin may be folded over giving lines for decoration as seen in the drawing of the finished garment

These are of woven cloth, remarkably fine, but of a curious pattern. They are like rectangular bags with a hole for the head and one for each arm. These people like many others did not cut their cloth but wove the garment entire. Now, weaving in the primitive sense, and even in modern times, must proceed in rectangular units; hence, a woven garment is bound to be rectangular and once again we find the contour of a shirt largely the inevitable result of the choice of materials.

Variations in the Indian woman's garment among different tribes. Even when the use of trade cloth has done away with some of the features of the original skin garments, the pattern concept remains the same

If, on the other hand, we go to the Eskimo collections, we find true coats of elaborate pattern, cut and fitted without apparent regard to the natural forms of the material. In contrast to all the clothing we have so far examined, these people cut up their material and fit it to the lines of the body; in other words, they are real tailors and very good ones too. The only other people in all the two Americas who cut up and fit their material are those living adjacent to the Eskimo in the north. In the Old World, we find that neither the Greeks nor the Romans cut their cloth but the ancient Chinese did. Then to the north of the Chinese we find in modern times the wild people of Siberia who made clothes like the Eskimo, as may be seen in the exhibits. The Lapps of Europe and possibly some of the early Slavs and Teutons were tailors, but if we pass over the strictly modern development of pattern cutting to fit the body, we find the idea only among the Chinese and the peoples occupying the Arctic belts of the Old and New World. Thus it is that the study of so simple a matter as clothing may lead the Museum visitor into an important chapter of the history of culture.



A CONTEMPORARY OF THE MASTODON

The great sabre-tooth tiger of prehistoric times was more than match for any other beast, from small game to elephant or mastodon. The tiger from whose skeleton the above restoration was made, found his end in the treacherous asphalt pools of Rancho-la-Brea, in California, into which no doubt he followed his prey. These pools, now dried up, no longer engulf the animals venturing upon them, but in Pleistocene times thousands were caught and buried beneath the black surface and the asphalt is full of their bones. Restoration by Erwin S. Christman

Scourge of the Santa Monica Mountains

By W. D. MATTHEW

HE stood, looking out from the rocky crest of mountain over the broad open valley that stretched for miles before him. It all belonged to him by "weapon-right" — to him and his race, by their strength and activity and the terrible curving sabres that were their favorite weapons. Individually or jointly none of the inhabitants of the plain dare dispute their sovereignty; bloody and merciless tyrants though they were, none could successfully resist them. Well might he stand, fearless and majestic, viewing the scattered timid groups of great pachyderms from whom he intended to select his next victim.

Before him lay the Los Angeles valley, wide, grass-covered, with clumps of trees and bushes dotting its surface. Near by were a few springs and water holes in a dry torrent bed that led down into Ballona Creek; to the eastward, in the hazy distance, he could trace the course of the river and beyond it the dim outline of the forest-clad mountains, all shimmering in the heat of a tropic summer day. Through a notch in the mountain spur to the southwest came trotting in single file a bunch of wild horses, bound from the uplands to the water holes in the valley. Swift handsome animals they were, dun-colored and obscurely striped, with heavy black manes and zebra-like heads. They came down the trail in an irregular broken line, two or three intimate companions trotting or running close together, the whole headed by a great piebald stallion of unusual size and strength. The sabre-tooth watched these for a few minutes as they approached. Should he select one of them for his prey? No, it would mean careful stalking and ambushing them at the water hole, and they were too swift and wary for him to have more than an off-chance of securing one. It was too warm a day, and he was not desperately hungry. He would levy his tribute some other time.

To the left, among the brush-covered sandy slopes that stretched along the foot of the mountain chain, a number of camels were browsing upon the bushes and small trees, stripping the leaves from the young shoots as far up as they could reach. These were big animals, taller than a modern camel, long-legged and clumsy in gait, with a heavy coat of shaggy hair of desert brown color, the body short and with no hump. They too, despite their apparent clumsiness and stupid appearance, were swift and wary creatures, little disposed to come within reach of the danger of an ambuscade and far too speedy to capture in an open chase. The sabre-tooth had no love for an open chase at any time; it was too tiring, and involved too much risk of stone bruises on his feet, or what was worse, getting thorns stuck between his toes. No, there was not much use watching the camels. They seldom came down to water, and when they did they generally selected one of those muddy, open, shallow pools with little or no cover near it. A really high class animal couldn't or wouldn't drink such water, muddy, foul, and always more or less alkaline — but these camels! Himself, when he drank, it was from a brook in the mountain forests where he slept at night.

He turned his gaze upon the low bottom flats in the valley before him where the grass grew rank and lush in places and small groups of bison and other smaller animals were feeding. The bison, big and black and shaggy-maned, with gleaming sharp horns and fierce little eyes peeping out from their woolly heads, their slim legs and lithe hind quarters in odd contrast to the bulky head and barrel, were no contemptible antagonists. They were, so his family traditions ran, comparative newcomers in this country, immigrants from some distant region who had crossed the mountain passes to the north, and were becoming more and more numerous in the valley, ousting many of its former inhabitants. They had brought with them some curious ideas about fighting, bunching together when attacked, in a ring with the young and females in the center, instead of

NOTE.— The American Museum of Natural History has arranged to secure a complete series of duplicates representing the fossil fauna of Rancho-la-Brea, Mar, Los Angeles, from the collections of the University of California. The asphalt group, the individual mounted skeletons of the sabre-tooth and the great wolf, and skulls of the extinct horse and the great California lion are now exhibited in the Tertiary mammal hall. [See the JOURNAL for November, 1913, pp. 291–297, for detailed description of the group with illustrations.]

scattering in flight and leaving the weaklings to their fate. The sabre-tooth found such methods of defense annoying and quite incomprehensible. If he attacked one of the bulls who stood in defense he could bring it down well enough, in spite of its horns and its massive strength. But then the other bulls would attack him, although they were not menaced at all, and could easily enough have escaped. It was risky and he didn't like it. What business had these others to interfere between him and his legitimate quarry? A surprise attack, of course, while they were still scattered out on the meadow before they could bunch together, would be less dangerous. But these rascals had pretty sharp eyes and ears, and if one of them saw or heard anything suspicious the whole herd would usually thunder off, and not stop until a good distance away. Then the stalking would have to be all done over again — and perhaps a third or a fourth time before he could really get at them. Too much trouble for a sultry lazy afternoon.

In the thickets and copses along the course of the river he could see the stirring of various kinds of smaller game. Peccaries, deer, raccoons, and rabbits, he knew lived in those glades and copses, and occasionally he would catch a glimpse of one. But these were all beneath his notice. He was not going to waste his terrible weapons upon such small fry. They didn't amount to anything when you did catch them and were just as much trouble to catch as the larger animals. Nor did he consider more seriously the fleet and graceful antelopes — pronghorns and one or two smaller kinds — that he could see far out in the open. They were too shy and too swift to be worth while.

Far off in the distance, showing up as mere dots on the slopes of the opposite hills, his keen eye discerned a prey that once within reach was well worth while, and while somewhat dangerous had never failed to succumb to the terrible wounds that his great dagger teeth and huge claws could inflict. He did not fear them, these elephants and mastodons, but they were too far away, and they were preternaturally shrewd in getting wind of him unless he took a long circuit and got to leeward.

Finally, as he watched the valley below him, his eye caught a glimpse of one — no two — big, shaggy, golden-brown animals moving through the brush near the dry creek bed. His eye flashed, his pose changed to a tense watch, with some uncertainty. It might be a couple of those big brown bears, redoubtable antagonists, whom he would hardly care to tackle without necessity. Of course he could fight and overcome a brown bear if he had to, but he still carried the scars of a former encounter with one of them and was not eager to renew the fray. But these couldn't be brown bears. Surely he had not mistaken that peculiar greenish gleam in the golden-brown backs. No — there it was again, for certain. This was his favorite prey — the big, clumsy, slow-moving ground sloth that waddled around in such stupid confidence that its heavy hair and thick bone-studded skin made it invulnerable. So it was to ordinary animals, but not to him. He could pierce that tough skin with tremendous hammer blows of his great dagger teeth, and tear wide gashes in neck and flanks until the beast bled to death. Of course one must be careful to avoid the ground sloth's long claws which could rip him up in turn if they could reach him in their wild thrashing. But he had never had any great difficulty. You sprang on the beast's back, and struck deep and hard before it could gather its wits together, and then dodged the great claws as they reached up first on one side, then on the other to drag you off. It didn't last long, if you gashed the neck at the right point.

He crouched down and began his stealthy approach. The ground sloths, unsuspecting, continued to strip the leaves off the trees about them, standing on their hind legs and reaching up to drag the branches down, then digging around a tall sapling to loosen its roots and pull it over. They were working their way, feeding as they went, toward a series of small pools which lay not in the creek bottom but about half a mile over, and on the crest of a low rise. They were curious looking pools, each surrounded by a bare black patch on which nothing grew. In dry weather they could be seen to be semi-liquid asphalt, covered by a scum of dust, through which broke from time to time bubbles of oil and evil-smelling gas. After a rain the asphalt surface was covered by a few inches of water, iridescent with a skin of oil and somewhat malodorous, but drinkable.

Had the ground sloths but known it, the place had an ugly reputation among the more intelligent animals of the neighborhood. It was reported to be haunted by mysterious earth demons, perhaps the same as the subterranean monsters who haunted the quick-

sands in the river, and who would reach up from below and, seizing the feet of the unfortunate animal who ventured into their lair, would drag it down slowly but irresistibly, struggling and screaming, into the depths below. Not all of the animals had heard of this rumor, and still fewer believed it. But many of them avoided the spot merely because of its weird uncanny surroundings, and only under stress of thirst in a dry season would they venture to drink here. There was often water here when there was none to be had elsewhere, perhaps because water came up with the oil and gas, perhaps because a light rain which elsewhere soaked into the dry soil would here collect in pools on the impervious asphalt. The elephants and mastodons, however, long-lived, shrewd, and highly superstitious, looked upon the place with horror, and could not be induced to venture into its vicinity. Once indeed, it was said, a party of elephants — but that is another story.

But the ground sloths knew nothing of the sinister reputation of the Black Pools. Nor perhaps would they have understood and avoided them had they known, for the shimmer and smell of water was enough to draw them to drink, and only an unbearably alkaline taste might have kept them away. Moreover they, like the bison, were comparative newcomers in the country, although they had come from the opposite direction, working their way up from the far south across the rugged Mexican plateaus and hills.

They continued their leisurely progress through the brush, crossed the bare black ground around the pools, and splashed into the largest one to drink.

For a moment nothing happened. They seemed to be standing on fairly firm although soft bottom. Then, slowly the bottom began to yield and their feet to sink in, and in terror they hastily turned to find firmer footing. But their feet, once through the crust, could not be withdrawn. They were held with incredible tenacity; if by desperate effort they dragged out one foot all covered by the sticky asphalt, it served only to sink the other limbs deeper and hold them more firmly. Little by little, in bawling terror, they were being dragged relentlessly down.

Meanwhile the great sabre-tooth tiger had been making his way silently but rapidly, taking advantage of every rock or bit of brush that might conceal his approach, across the valley toward his intended prey. He had come up near behind them when they reached the asphalt pool and now stood lurking in the edge of the brush, ready to rush out and spring upon them as they drank. His eyes blazed in triumph as he noted that first one, then both, were in some kind of difficulty and their movements hampered. With a fierce roar he leaped out from the thicket, flashed across the bare ground between, and sprang upon the back of the nearest ground sloth, and, digging his great claws into its hide, struck his fangs deep into its neck. Perhaps his aim was bad, his hold a little disturbed by the now rapid sinking of his victim into the oozy black depths of the pool. The sloth with a desperate wrench of its body shook him off to one side and he rolled over upon the surface of the asphalt. In a moment he regained his feet, and turned to strike again at the neck of the animal at his side, already sunk more than half below the surface. But in that moment the demon of the Black Pools seized him and held him in its dreadful clutch, first by the fore feet, then the hind feet as well. Strive as he might he could not release more than one foot at a time, and that but for the moment. He forgot all thoughts of prey and turned with a choking snarl to drag himself out. But it was too late. The fierce sabre-tooth, the tyrant of hill and valley, the dreadful scourge of the prehistoric world that we have looked upon for a moment, was hopelessly doomed to follow his intended victim to an awful and lingering death in the black and sticky depths of the asphalt pool, from which rose now, faster and faster, bubbles of oil and malodorous gas as the struggling animals sank lower and lower beneath the surface.

The screams of the terrified animals had been heard far and wide over the valley, and the sight of their struggles had attracted the great birds that were soaring high above in the air. One by one they came dropping down — vultures, condors, eagles, and smaller birds of prey, and formed a hopping flapping ring, pressing forward to share in the expected feast. A pack of wolves, the great extinct wolf of California, was following up a near trail, but attracted by the disturbance came trotting over to the scene. The leader recognized with savage joy the predicament of the sabre-tooth, his dreaded rival, before whose fierce snarl and menacing claw he had more than once been reluctantly driven from an expected banquet. The hour of his revenge was now at hand. He came forward,

followed by his mates, to the edge of the pool, and dancing about in wild excitement yelped out his opinions of sabre-tooth tigers in general and this one in particular, before taking advantage of his adversary's helplessness to spring in upon him and devour him. The harassed sabre-tooth sinking slowly down can respond only by a succession of snarls as he tries vainly to disengage his terrible claws to strike at his enemy.

Here the picture stands, as we have attempted to reproduce it in the American Museum's "Asphalt Group" exhibit. The tragedy, whose course has been outlined in fancy in the above sketch, was repeated again and again in the treacherous asphalt pools of La Brea during the course of the Pleistocene involving thousands upon thousands of animals large and small. Finally, the petroleum springs became less active, the pools dried up in part so as to be no longer a serious menace to the animals that ventured upon them, and in our time only a few minor springs remain, dangerous occasionally still to small animals, while the chimneys or openings of the ancient springs are filled with a half-hardened asphalt, of the consistency of brown sugar, and packed full from bottom to top with the bones and skulls of extinct animals and birds, perfectly preserved from decay by the asphalt that surrounds and permeates them. More than two hundred skulls of the great sabre-tooth tiger, the especial subject of this sketch, have been exhumed by the University of California; nearly a thousand by the Los Angeles Museum. The great wolf is even more abundant, and many skulls and skeletons of extinct horses, camels, bisons, ground sloths, and numerous smaller animals, besides the remains of over fifty kinds of birds, have been obtained from the pits. Animals and birds of prey are much more numerous than the rest, indicating that the struggling victims served as a lure to decoy many more to share their fate. It is a singular fact that although the southern mammoth, or extinct elephant, is known to have been common in the region at the time, its remains are not found in the asphalt deposits except at one locality where seven skeletons were crowded together in a single pit.

Why Does the Heart Beat?[1]

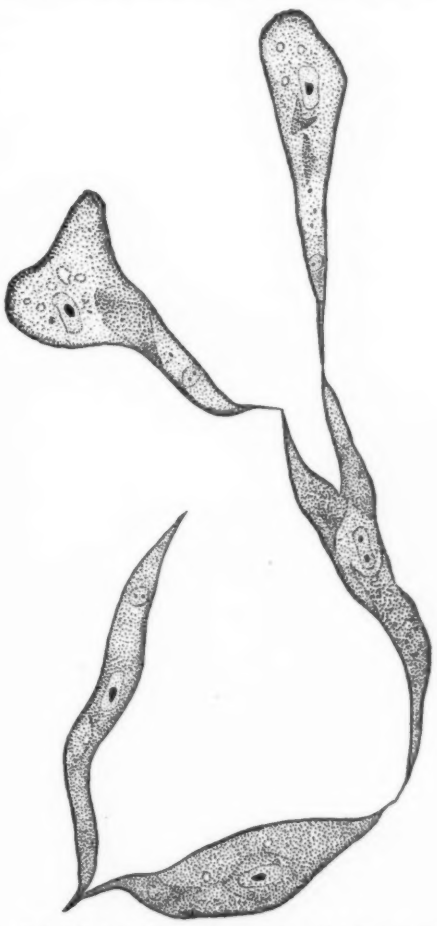
By R. W. TOWER and C. F. HERM

WHY does the heart beat? It is a question not altogether easy to answer. Perhaps there is no adult who has not counted his own or another's pulse and wondered at the regularity of the rhythm with which the phenomenon proceeds. Doubtless every one who has dressed his own catch after a successful fishing trip has observed how the heart of the animal beats for some time after it has been removed from the body, and has asked himself: Why this activity and how is it controlled? Is this rhythmic contraction of the heart muscles, continuing day after day, year after year, dependent upon factors outside of the heart, upon stimulations carried to it over nerves from other organs of the body, or is it of an automatic nature, depending upon conditions and stimulations from within the organ — a function of the very heart cells themselves? The answers have been as many and varied as there have been questions.

The problem is difficult and complicated. That the heart of a cold-blooded animal will continue to beat some time after being taken from the body has been observed by almost every one, but this proves nothing. That the activity of the heart is regulated by nerve centers outside of itself is undoubtedly true, but this in no way concerns the cause of the rhythmical contraction. It is well known however, that there are within the organ numerous nerve cells which, although cut off from their central office, yet through their natural properties might cause the systematic beating.

The cause may also be sought in the nature of the muscle itself, in which case it is assumed that the muscle cells possess the inherent quality of contraction. Many experiments have been performed to solve this interesting problem in a convincing manner. Very recently it has been found possible to grow heart muscles of a warm-blooded animal in an incubator, and during this growth a single muscle cell has been observed to wander away from the mother tissue and by itself begin to beat. It would therefore seem that the individual isolated cell, having grown to a certain size and finding the necessary food, the necessary warmth, the necessary oxygen, or in other words the correct environment, will begin to beat — that is its business, it cannot help it.

Again, several cells, while growing, may attach themselves one to another forming clusters of various appearances, and these cells after a time begin to beat, not each one separately but all together, the rhythm persisting at perhaps one hundred times a

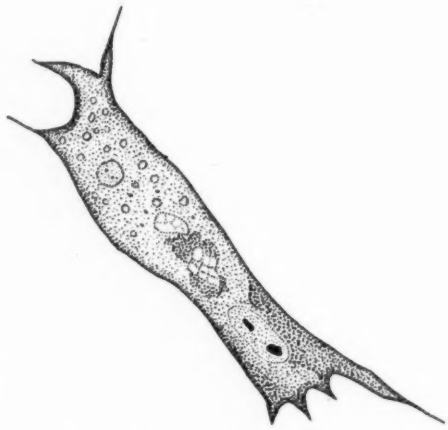


Series of single heart-muscle cells which have been observed to grow, beat separately, unite with one another, and finally beat in unison

[1] Observations from the experimental work in the physiological laboratory of the American Museum.

minute for several days. In other cases, where several single heart-muscle cells are unconnected, they will be seen to contract, not synchronously but the one independent of the other. These interesting observations rather indicate that the heart cells have an inherent ability to contract and must so do when placed in a favorable environment. Rhythmic contraction is their function.

In the developing embryo, these rhythmically contracting cells grow together, side by side, end by end, forming elongated muscle fibers, which placed layer upon layer, eventually form the contractile portion of the cone-shaped heart. Together with this growth there develop nerve terminals, or ganglia, and nerve fibers which connect the four-chambered heart with the central nervous system. This is essential for, although the heart is capable of automatic rhythmic movement due to the inherent property of the muscle cells as we have already explained, it is extremely important that this rhythmic contraction should properly serve the needs of its possessor. It is necessary that some control should be exerted over its activities, so that when the beat becomes slow, it should be accelerated, and when too rapid, it should be inhibited. These results are obtained by two sets of nerve fibers coming from the central nervous system. One set carries diminishing, or inhibiting, stimuli, the other augmenting, or accelerating, stimuli. Because the rate of the heartbeat changes quickly in response to variations of internal and external conditions, these regulatory nerves are of the greates' value, for through their agency, the motor power of the circulation is quickly adjusted to suit the changing needs of the organism and is adapted to changes in the external environment.



Single muscle cell from heart of an eight-days-incubated chicken. When a section of the heart tissue is planted in the blood plasma and placed in an incubator, cells like above grow out from it, isolate themselves, and begin to contract rhythmically

Museum Notes

SINCE the last issue of the JOURNAL the following persons have become members of the Museum:

Fellow, MR. CHARLES STEELE.

Life Members, MR. GAYLORD C. HALL and MASTER ALEXANDER SANFORD KELLOGG.

Annual Members, MRS. ROBERT C. BEAL, MRS. MARTIN BURKE, MRS. JOHN PEYTON CLARK, MRS. N. R. NORTON, MRS. VICTOR M. REICHENBERGER, MRS. CHARLES WARD SANDS, MISSES ABBY B. BATES, and M. M. ROONEY, REV. JOHN ADDAMS LINN, and MESSRS. E. BENJAMIN, JOHN EVARTS CLANCY, BENJAMIN DORMAN, ROYAL P. HAMERSCHLAG, ROBERT S. LEMMON, GEORGE MCNEIR, A. PAGENSTECHER, Jr., and MORRIS RIPPENBEIN.

THE *Tillotherium* is an animal belonging to an extinct group of mammals whose remains are found only in Eocene formations, and although the American Museum's field expeditions have searched these formations for many years, never has any but the most fragmentary material relating to this animal been found. This year, however, Mr. Walter Granger, of the Museum's department of vertebrate palæontology, discovered skulls, jaws, and probably all parts of the skeleton, so that a reconstruction will soon provide a means of establishing some valuable relationships.

THE American Association for the Advancement of Science, which will meet in

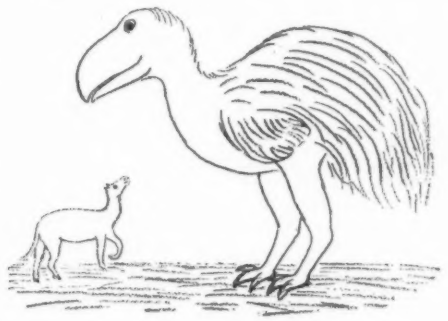
New York City in December, has accepted the invitation of the trustees and scientific staff of the American Museum for the evening of December 26. An address by the retiring president of the Association, Dr. W. W. Campbell, of Lick Observatory, will be given in the auditorium, followed by a reception in the hall of the Age of Man. In connection with this meeting of the Association, arrangements are being made for a special exhibition by the National Research Committee of the Association, in coöperation with the American Chemical Society, showing the application of scientific research in chemistry to pure science, industrial progress, and national defense.

Two rare specimens of horses have been secured by Professor Henry Fairfield Osborn for the horse collection of the American Museum of Natural History. They have been sent to this country by Professor J. Cossar Ewart of the University of Edinburgh and are now at the New York Zoölogical Park. One of them, a yellow-dun animal, represents the type of horse known and described by Linnæus in 1766, and is a result of breeding back; the other, a gray-dun specimen, is a true Celtic pony, the same species as that depicted in the caves of France and Spain thirty thousand years ago by the artists of the Old Stone age. This pony was selected by Professor Ewart out of a herd of five hundred sent from Iceland.

On July 20 of this year the library of the American Museum became possessed of three more of the stupendous works on birds written by that able English naturalist and master of taxidermy, John Gould, F. R. S. The volumes represent the generous and timely gift of Mr. Ogden Mills and are entitled: *The Birds of Europe*, (5 vols. London [1832–]1837); *The Birds of Great Britain*, (5 vols. London [1862–]1873); and *The Birds of New Guinea and the Adjacent Papuan Islands*, (5 vols. London 1875–1888). The books are folio in size, handsomely bound, and profusely illustrated with color plates. Their acquisition is greatly appreciated by the ornithologists of the Museum, and outside readers have already consulted them frequently. The matter, moreover, becomes a cause of justifiable pride in that the library's collection of Gould is now, with a few exceptions, on a par with that of the British Museum. Finally, it is gratifying to note that the many artists and designers who have lately discovered in the library's files on textiles and primitive art a new well of inspiration, are beginning to grow equally enthusiastic over the bird plates in Mr. Mills's latest gift.

The arrival of the steamer "Danmark," which was chartered to bring back the members of the Crocker Land Expedition to this country, is expected daily. The "Danmark" received her instructions and left her winter quarters in south Greenland on July 18, 1916, and was reported off Upernivik on August 3, 1916. From earlier reports it would appear that the "Kap York" and the "Danmark" were both probably in the vicinity of Cape York about the middle of August. The Crocker Land Committee has no information of the cause of the unexpected delay in the return of the "Danmark." No anxiety need be felt, however, for the safety of the party, even though the vessel should have been unfortunately caught in the ice. The "Danmark" is a very staunch wooden vessel of four or five hundred tons and is thoroughly equipped for her work. A mail is due from Greenland the latter part of November.

The skeleton of a gigantic and very remarkable fossil bird was the most important discovery made by the field parties from the department of vertebrate palæontology last summer. It was found in the Lower Eocene of Wyoming by Mr. William Stein. Fossil



birds are excessively rare in any of our western fossil fields, and this discovery was wholly unexpected. The bird was much larger than an ostrich, although not so tall, and had a huge head with high compressed beak, unlike any living bird. Its size and remarkable proportions are well shown in the illustration

in comparison with the little four-toed horse (*Eohippus borealis*) its contemporary, whose remains are common in the same formation. The fossil skeleton is now being prepared in the Museum's department of vertebrate palæontology and will be ready for exhibition, it is hoped, some time during the winter.

Dr. Robert H. Lowie has recently returned from an expedition of several months' duration to the West. Much of the time he spent among the Hopi Indians of northern Arizona in a study of their social organization and ceremonials. Dr. Lowie was permitted to witness two of the extraordinary snake dances of this tribe in the villages of Oraibi and Shungopavi, as well as the flute ceremony, performed this year at Walpi. The significance of the clan system in ceremonial life was especially studied among the Hopi. Dr. Lowie also visited the Arapaho Indians, of central Wyoming, to secure supplementary data for the comparative survey of the societies of the Plains Indians which has now been completed by the department of anthropology.

An extensive collection of fossil mammals, obtained this summer in Porto Rico by Mr. H. E. Anthony of the Museum's department of mammalogy, has peculiar interest in view of the fact that today bats are the only mammals found on the island. The fossil specimens include some large rodents about the size of a beaver, distantly related perhaps to the agoutis of Central America and also, perhaps, to the climbing rats of Cuba and Santo Domingo. A ground sloth found indicates a smaller animal than the ground sloths of Cuba, South America, and Patagonia; it may possibly prove a connecting link between ground sloths and tree sloths. Remains of a very interesting insectivorous mammal, distantly related to the common shrew of North America, were also discovered. This creature has so many primitive characters that it seems as though it might have outlived all of its relatives on the mainland. The discovery of these fossils suggests that the fauna of Porto Rico may formerly have been much more extensive than we now have any idea of. The problem is to determine how these animals arrived there. The large size of several of the fossil mammals, notably the large rodent and the ground sloth, would make it appear doubtful that these animals came into the Greater Antilles on a floating raft from the region of the Orinoco and Amazon. A former mainland connection with Florida or Yucatan may have existed at one time. Before anything can be determined certainly, further exploration of the island will be necessary and careful comparison of the fossil forms with the animals of other land areas. All the animals found are quite distinct from those of Santo Domingo and Cuba. Twelve species of bats were found, one of which is a rediscovery of a species (*Stenoderma rufum*) known before only by a single specimen, which moreover was lost, so that only a plate and description of the animal is extant. This occurs in a book on the mammals of Egypt written by E. Geoffroy Saint-Hilaire in 1813. A large number of fossil specimens of this bat were found.

A new exhibit in the North American mammal hall on the second floor of the Museum is a large group illustrating the color phases of the common black bear, *Ursus americanus*. The general color of this bear, which never varies in the Eastern States, is black; in the Rocky Mountains a cinnamon bear occurs, black and cinnamon cubs being often found in the same litter; at Gribbell Island off the coast of British Columbia and on certain parts of the mainland there is found a white bear, tinged with orange on head and back; while a bluish bear ranging in color from black to light gray, lives on the icy heights of Mount Saint Elias in southeastern Alaska. These distinct color phases were at one time looked upon as constituting different species but it is now certain that this is simply a case of polychromatism of the black bear, not unlike the dichromatism of the screech owl, where brown or gray phases may occur in the same nest. The specimen of the blue bear shown in the group was presented to the Museum by Mr. G. Frederick Norton of Goshen, New York, and it is through his interest and by study of the many specimens obtained by him, that it has been possible definitely to determine that the glacier bear is only a phase of the black bear. The background for this group has been painted by Mr. Albert Operti.

The first complete skeletons ever discovered of the fossil horse *Pliohippus* have recently been purchased by the Museum and constitute a very important acquisition.

BEARS OF SEVERAL COLORS BUT ONE SPECIES

The black bear is a forest animal and its range includes the entire continent wherever there are forests, from Maine to California and from Alaska to New Mexico — but the black bear is not always black. There are blue, and white, and cinnamon bears, once considered to be different species, but now known to represent merely color phases of the one species (*Ursus americanus*). The blue or glacier bear, in the left background of the American Museum group reproduced above, came from Alaska; the white bear came from British Columbia; but the cinnamon bear occurred in the same litter as the black bear next to it — and in any of these instances color does not indicate even a geographical subspecies

One of these is a full-grown skeleton found by Mr. Harold J. Cook last winter in the Pliocene of western Nebraska; the other is a young skeleton of the same species found a year ago by Mr. E. L. Troxell in the pliocene of western South Dakota. The pliohippus belongs to a genus intermediate between the latest stage of the three-toed horses, and the modern horses, in which the side toes are reduced to rather short splints. These particular skeletons are therefore interesting as filling a gap between the three-toed and modern types, because, while clearly belonging to the three-toed group of horses, they are intermediate in size and construction of teeth, and the side toes are reduced to splints — but very long splints, especially on the fore feet. The teeth, skull, and other characters are like the three-toed group but in every detail they show more or less progress toward the modern horse construction.

THE city of Philadelphia holds in trust under the legacy of John Scott of Edinburgh, (made a hundred years ago), a sum of money the interest of which is awarded each year, in the shape of a medal and premium, to "ingenious men and women who make useful inventions." This honor has recently been conferred on Mr. Carl E. Akeley, of the American Museum, for his invention of the cement gun. The invention dates from 1907 when the director of the Field Museum, Chicago, consulted Mr. Akeley as to the best method of recoating the old Field Museum building — previously stucco. Experiments then made resulted in the cement gun which is now finding application for varied purposes. The principle of the gun consists in forcing into a hose by means of compressed air, a mixture of dry cement and sand contained in a sealed hopper. This mixture is carried in suspension through the hose by the compressed air and is met at the nozzle by a stream of water, also under pressure, supplied by another hose. Thus, hydration takes place at the moment the stream of material is directed to its permanent position, and the resulting product is infinitely stronger than any other form of concrete because there is no loss of the initial "set," which always begins the moment hydration takes place. Also, being sprayed on under pressure, each grain is tamped firmly on the one ahead. The gun is being extensively used, not only to coat buildings, but also to make tanks and reservoirs water-tight; to line the workings of coal and other mines where falling in of the roof or walls is feared; for coating steel structures to prevent corrosion; and for railroad tunnels. A wooden pile seventy-five feet long can be coated and then driven without breaking the cement, and such piles are now being used where the boring mollusk *Teredo* is liable to effect destruction of wood.

A MOUNTED specimen of the rare and valuable Père David's deer (*Elaphurus davidianus*) has been purchased by the Museum from Rowland Ward of London, and is now exhibited on the second floor. This, the rarest as well as one of the most interesting species of deer in existence, was first discovered to Europeans in 1860 by the French missionary and explorer Père Armand David, who found it inhabiting the great hunting park attached to the imperial palace at Pekin, China. This park, surrounded by a brick wall forty-five miles in circuit, and formerly strictly guarded, is said to have been the home of large herds of deer of various kinds. Père David's deer, known to the Chinese as the *mi-lou*, has never been found wild in any part of Asia by Europeans and the date of its introduction into the imperial park is probably very remote; it is not known to have been living in any other place. Unfortunately, the Hun-ho River, flowing through the park at Pekin, became flooded and made several breaches in the walls, through which all the *mi-lou* deer escaped. They were killed and eaten by the peasantry who were then suffering from famine. A few pairs had previously been sent to Europe, including a pair to the great park of the Duke of Bedford at Woburn Abbey, England, and the descendants of this pair — a small herd only — are probably the sole living representatives of the *mi-lou* deer today. This species has no near relative of its kind. It differs from all the Old World deer, except the moose and roe, in having forked antlers and no brow tine, and from the American species of deer with forked antlers in that the hind prong of the main fork forms an undivided tine of great length directed backward. In the Virginia deer and its relatives the front tine remains simple and the back fork is again divided into two or more prongs. The long donkey-like tail and slouching carriage of the *mi-lou* are also characteristic. Lydekker considers that the *mi-lou* and

American deer — other than the moose, wapiti and reindeer — are both probably descendants of an extinct group with antlers of the same general type, which flourished in Europe during the latter portion of the Tertiary epoch.

THE archæological expedition to the valley of the Zuñi River, conducted by Mr. Leslie Spier, of the Museum staff, has returned with collections and data from the oldest ruins known, to that captured by the Spanish in 1540. This makes possible a historical reconstruction of the occupation of the valley. The method used is a new one and consists in locating the ash heap of any ruin — usually found to the southeast of the ruin — sinking a trench into it, and collecting pottery fragments from the top to the bottom of a selected section. The types of pots and the proportions of these at different levels show the changes in ceramic art in the progress of time, and it is believed that the sequence of pottery types can be used as a temporary scale for the chronology of the ruins. The sherds at the bottom of a pile indicate the date of the foundation of the village, those at the top the date of its abandonment for some other site, and the time, duration, and manner of occupation of the different villages can be determined in relation to other villages. It is planned to carry this historical investigation throughout the Southwest.

THROUGH the generosity of the Honorable George Shiras, 3d, the Museum was able to send Mr. H. E. Anthony into the field in Ontario during the latter part of the summer. Mr. Shiras planned the trip primarily for the purpose of obtaining photographic studies of the region north of Lake Superior and secondarily for the study of moose. The party was in Ontario about three weeks and a good male moose specimen was secured for the Museum's study series.

MR. CARL E. AKELEY was elected president of the Explorers Club of New York City at a business meeting of the council of the club held November 10. Rear Admiral Robert E. Peary was made honorary president of the club at the same meeting.

THE Jesup lectures, under the auspices of Columbia University in coöperation with the American Museum, will be given at the Museum on Friday evenings at 8.15, beginning November 10 and lasting through December 29. The subject of these lectures will be "Dynamic Psychology," and the lecturer will be Dr. Robert S. Woodworth, professor of psychology in Columbia University.

A HABITAT group of African monkeys (*Colobus*) has been installed opposite the entrance to the Primate hall on the third floor of the Museum. These monkeys, distinguished by their long, silky, black and white coats, and by the absence of a thumb, are restricted to the African continent, where they live in the dense tropical forests from Gambia and Abyssinia in the north to Angola and Nyassaland in the south. The young of this species is born white, but the color changes so rapidly that this fact was long in doubt. Animals from two localities, selected to show various stages in coloration from youth to old age, are included in the group. They were mounted by Mr. Frederick Blaschke in the Museum's taxidermy studio. The leaves, vines, and air plants used in the setting were made from specimens obtained in Africa by Messrs. Herbert Lang and James L. Clark.

A CURIOUS example of primitive armor, made of coarsely woven maguey fiber and found in a prehistoric grave at Chiuchiu, Chile, has been presented to the Museum by Messrs. Guggenheim Brothers, having been collected by Mr. Harry F. Guggenheim. The specimen, which is extremely rare and unusual, is made like a poncho, with the sides closed, leaving openings for the head and arms. It is decorated with pile knots made of human hair.

THE unusual spectacle afforded this past summer by three American egrets which spent the greater part of three months in the neighborhood of Van Cortlandt Park, New York, has considerable ornithological interest. One of the shyest and rarest of American birds, and one whose persecution by plume hunters has rendered it necessary to protect it by law, the egret has been very rarely reported in the north for many years. That these specimens should have elected to frequent a flooded swamp so near the city, surrounded on all sides but one by constant and noisy traffic, is nothing short of remarkable, in spite of the fact that the pond affords

the birds good fishing. The breeding range of these birds extends from the tropics as far north as Virginia, but after the breeding season it is not unusual for wanderers to travel north, and at one time they might be found as far north as New Brunswick, returning south in the autumn. The three birds noted near the city came to the pond on July 16, and remained until August 3, when two of them left. The remaining bird was seen alone daily until August 8, when another joined it and both remained until August 20.

THE cast of the white shark or "man-eater," which was shown for several weeks last summer in a temporary shark exhibit in the Museum foyer, has been hung with the systematic collection of fishes on the second floor. The blue shark model from the same exhibit will be used in a blue shark group now being prepared under the direction of Dr. Bashford Dean. The Museum has recently received, from Mr. F. M. Dyer of New York, the jaws of two blue sharks. These sharks were taken off Provincetown, Cape Cod, by the Bay State Fishing Company and are said to have been thirteen feet in length. The blue shark seems to be common offshore although it is seldom reported from the coast. A sand shark, between seven and eight feet in length, has been received from the New York Aquarium. This species rarely reaches so large a size in this latitude.

COURSES of lectures open to school children will be given at the American Museum at four o'clock in the afternoon on Mondays, beginning October 16 and lasting through November 20; Wednesdays, beginning October 18 and lasting through November 22, Fridays, beginning October 20 and lasting through November 24, and Tuesdays and Fridays, beginning November 21 and lasting through December 15. A people's course will be given on Tuesday and Saturday evenings at 8.15, in conjunction with the department of education, beginning October 31 and lasting through December 23.

THE most recent addition to the series of life-size figures illustrating the races of mankind in the Primate hall of the American Museum is a model of the native African, Manziga, chief of the Azande. The model has been made from studies and photographs taken in Africa by Mr. Herbert Lang. The Azande are typical negroes, tall and dark-skinned; and with this figure and the two already completed, those of a Norwegian girl and of a Cantonese laborer, the three great races, yellow, black, and white, are now represented in the series — which will be supplemented later by skulls and skeletons for comparative study.

DR. FRANK M. CHAPMAN returned to New York on November 11, from his tour of the South American countries, where he had been engaged in continuing the biological survey of these regions, which has been in progress for the past six years. Dr. Chapman was everywhere received with the greatest courtesy by government officials as well as by local scientists, and in addition to making valuable collections of birds and carrying out the scientific work of the expedition, he established friendly relations with South American museums, which will facilitate exchanges and yield important results in the future for the American Museum.

A COLLECTION of one hundred and three pottery vessels purchased by the department of anthropology from Mr. E. D. Osborn, of Deming, New Mexico, show animal and human figures of a type not found on other black and white pottery so far discovered. The pottery belonged to the prehistoric pueblo peoples of New Mexico and represents the oldest period of prehistoric pueblo life.

Two interesting lots of fossils from the phosphate beds of Florida have recently been presented to the Museum. The first includes a skull of the extinct Florida gavial (*Tomistoma americana*) recently described from parts of the jaws by Doctor Sellards. Both alligators and true crocodiles still survive in Florida; the gavials differ from them in the long slender "panhandle" snout and are now found only in East Indian waters. The specimens were presented by the Amalgamated Phosphate Company, through courtesy of Mr. Anton Schneider, general manager. The second lot consists of a number of bones and fragments believed to be from Zolfo, Florida, but collected many years ago. They are chiefly bones of a *Megatherium*, and notable for their gigantic size — about one-fourth larger than those of the great skeleton in the British Museum. They may perhaps claim to represent the largest known land mammal. The donor is Mr. J. F. Heller.

The American Museum of Natural History

Seventy-seventh Street and Central Park West, New York City

Open free to the public on every day in the year.

The American Museum of Natural History was established in 1869 to promote the Natural Sciences and to diffuse a general knowledge of them among the people. It is dependent upon private subscriptions and the fees from members for procuring needed additions to the collections and for carrying on explorations in America and other parts of the world. The membership fees are,

Annual Members	$ 10	Patrons	$1,000
Sustaining Members (annually)	25	Associate Benefactors	10,000
Life Members	100	Associate Founders	25,000
Fellows	500	Benefactors	50,000

Guides for Study of Exhibits are provided on request to members and teachers by the department of public education. Teachers wishing to bring classes should write or telephone the department for an appointment, specifying the collection to be studied. Lectures to classes may also be arranged for. In all cases the best results are obtained with small groups of children.

The Museum Library contains more than 60,000 volumes with a good working collection of publications issued by scientific institutions and societies in this country and abroad. The library is open to the public for reference daily — Sundays and holidays excepted — from 9 A. M. to 5 P. M.

The Technical Publications of the Museum comprise the *Memoirs*, *Bulletin* and *Anthropological Papers*, the *Memoirs* and *Bulletin* edited by J. A. Allen, the *Anthropological Papers* by Clark Wissler. These publications cover the field and laboratory researches of the institution.

The Popular Publications of the Museum comprise the JOURNAL, edited by Mary Cynthia Dickerson, the *Handbooks*, *Leaflets* and *General Guide*. The following list gives some of the popular publications; complete lists, of both technical and popular publications, may be obtained from the Librarian.

POPULAR PUBLICATIONS

HANDBOOKS

NORTH AMERICAN INDIANS OF THE PLAINS. By Clark Wissler, Ph.D. *Paper, 25 cents; cloth, 50 cents.*

INDIANS OF THE SOUTHWEST. By Pliny Earle Goddard, Ph.D. *Paper, 25 cents; cloth, 50 cents.*

ANIMALS OF THE PAST. By Frederic A. Lucas, Sc.D. *Paper, 35 cents.*

DINOSAURS. By W. D. Matthew, Ph.D. *Price, 25 cents.*

ILLUSTRATED GUIDE LEAFLETS

GENERAL GUIDE TO THE COLLECTIONS. New edition issued August, 1916. *Price, 25 cents.*

THE COLLECTION OF MINERALS. By Louis P. Gratacap, A.M. *Price, 5 cents.*

NORTH AMERICAN RUMINANTS. By J. A. Allen, Ph.D. *Price, 10 cents.*

THE ANCIENT BASKET MAKERS OF SOUTHEASTERN UTAH. By George H. Pepper. *Price, 10 cents.*

PRIMITIVE ART. *Price, 15 cents.*

THE BIRDS OF THE VICINITY OF NEW YORK CITY. By Frank M. Chapman, Sc.D. *Price, 15 cents.*

PERUVIAN MUMMIES. By Charles W. Mead. *Price, 10 cents.*

THE METEORITES IN THE FOYER OF THE AMERICAN MUSEUM OF NATURAL HISTORY. By Edmund Otis Hovey, Ph.D. *Price, 10 cents.*

THE HABITAT GROUPS OF NORTH AMERICAN BIRDS. By Frank M. Chapman, Sc.D. *Second edition issued May, 1916. Price, 25 cents.*

THE INDIANS OF MANHATTAN ISLAND AND VICINITY. By Alanson Skinner. *Price, 20 cents.*

TREES AND FORESTRY. By Mary Cynthia Dickerson, B.S. *A new edition in course of preparation.*

THE PROTECTION OF RIVER AND HARBOR WATERS FROM MUNICIPAL WASTES. By Charles-Edward Amory Winslow, M.S. *Price, 10 cents.*

PLANT FORMS IN WAX. By E. C. B. Fassett. *Price, 10 cents.*

THE EVOLUTION OF THE HORSE. By W. D. Matthew, Ph.D. *Price, 20 cents.*

MAMMOTHS AND MASTODONS. By W.D.Matthew, Ph.D. *Price, 10 cents.*

HOW TO COLLECT AND PRESERVE INSECTS. By Frank E. Lutz, Ph.D. *Price, 10 cents.*

OUR COMMON BUTTERFLIES. By Frank E. Lutz, Ph.D., and F. E. Watson. *Price, 15 cents.*

THE BIG TREE AND ITS STORY. *Price, 10 cents.*

REPRINTS

THE GROUND SLOTH GROUP. By W. D. Matthew, Ph.D. *Price, 5 cents.*

THE WHARF PILE GROUP. By Roy W. Miner, A.B. *Price, 5 cents.*

THE SEA WORM GROUP. By Roy W. Miner, A.B. *Price, 10 cents.*

THE ANCESTRY OF THE EDENTATES. By W. D. Matthew, Ph.D. *Price, 5 cents.*

HEREDITY AND SEX. By Frank E. Lutz, Ph.D. *Price, 10 cents.*

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